

Cameras Under Fire

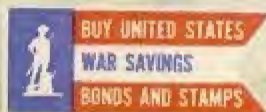
POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REGD. TRADE MARK GREAT BRITAIN No. 40426

REG. U.S. PAT. OFF.

OCT.
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30¢ IN CANADA



BUY UNITED STATES
WAR SAVINGS
BONDS AND STAMPS

SEE PAGE 26



Remember when . . .

You could buy a pre-war tire like this?

It was made of natural rubber by top-flight Seiberling craftsmen. It was good to look at, and good to ride on because it delivered many an extra mile of safe, comfortable driving-per-dollar. Both those who rode on it and those who sold it recognized it as America's FINEST Tire.

AND NOW AGAIN

in the new Seiberling Tire made from synthetic rubber . . . you get that "something extra" you've learned to expect from Seiberling. Rich experience, engineering skill and manufacturing craftsmanship have transformed wartime synthetic rubber into handsome, durable Seiberling Tires. They are the latest achievement of "Experts in Rubber" devoted to building the best.

And when you get your new Seiberling Synthetic Tires, you get still another "best." You get a personal, "interested in you" service that's extra valuable now. Your Seiberling Dealer is an Independent Dealer—a self-reliant man who has had the initiative to build his own business

—the kind of man who has helped create freedom and opportunity in America. He has the strongest of all incentives to serve you well . . . his success and his future depend upon it.

Although tires are more plentiful than they have been for a long, long time, please remember this: We still cannot risk creating another severe tire shortage through abusing the tires we have. This is especially important now because synthetic rubber is a new material that requires extra care. Don't drive your synthetic tires either under or over inflated, and be sure to have small cuts and bruises repaired promptly. There's where your Seiberling Dealer can help you. He is an "Expert in Rubber."

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Wartime manufacturers of Bullet-Sealed Tubes and Military Tires for our armed forces • Bullet-Sealing Gasoline Tanks • Rubber Floats, Boats and Pontons • Rubber Parts for Gas Masks, Airplanes and Tanks. Also makers of Tires and Tubes for passenger cars and trucks • Sealed Air Tubes • Rubber Heels, Soles and Mechanical Goods.

Here's how your car FEELS...

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chassis
lubrication!

It drives so smooth and effortlessly, fairly soars along — after a MARFAK job. Yes, Texaco MARFAK chassis lubrication is great at making life easy for your car. Because MARFAK is extra tough and longer-lasting, it helps your car *live* longer too! MARFAK is applied by chart, never by chance. From king pins to rear shackles, every point of wear, every point of adjustment is checked when you ask your Texaco Dealer to give your car that "MARFAK feeling." Ask him today!

THE TEXAS COMPANY



Let us
MARFAK
your car



TUNE IN the TEXACO STAR THEATRE starring James Melton every Sunday night. See your local newspaper for time and station.

OCTOBER, 1944

This One



KXCP-NHW-B8FN

1A



Camouflaged Communications Center of American Command Post during heavy fighting

Front Line Telephone Post

TELEPHONE lines are life-lines wherever our men fight. The lines lengthen with every mile of advance.

Bell System manufacturing facilities have had to be devoted almost exclusively to keeping the armed forces supplied with communication and electronic equipment. As a result, we are

short of telephones, switchboards and other equipment needed to meet civilian requirements.

We're sorry if you've had to wait for home telephone service. But you can be sure that every effort is being made to take care of your needs just as soon as the war allows.

BELL TELEPHONE SYSTEM



• Please give the service men and women first chance at Long Distance between 7 and 10 each night.

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

October, 1944

Vol. 82, No. 4

Next Month

G. I. HOTFOOT is not what you get from a 30-mile forced march. It's Yankee for the new squirt gun that throws a rope-like flame straight through the two-inch slit in a Jap pillbox 180 feet away. When it hits, the jellied gasoline spatters gobs of flaming goo that literally cook everything within the bunker. A sockful of that same deadly fuel comes shooting out of the new incendiary bombs that are 150 times as destructive as blockbusters. "Sixty-Yard Flash," a November feature, tells how we learned about flamethrowing from the Germans—then improved on our teacher.

Mecca for Millions

MOST of the hundreds of thousands who hurry through New York's Grand Central Terminal daily are not interested in the trains that come and go at a rate of one a minute. Some 230,000 rail travelers passed through the station one day recently, but 600,000 more, non-passengers, hustled through its concourses and underground passages. "Mecca for Millions," a November article, takes you through Grand Central, where everybody meets in wartime.

Wartime Test Pilots

SINCE the last test pilot brought his flaming plane safely to land and then was badly burned getting out of it, the strict rule at Douglas is to jump. Pilots are worth more than planes. So, despite an occasional thrill as when a Skymaster started shaking to pieces, there have been no fatalities among the wartime test pilots at Douglas. Read about them next month.

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Cowboys of the Sea

THERE is something of the spirit of the wild west in the "cowboys" who ride our bucking PT boats on nightly hunts for Jap ships in the South Pacific. You have to be tough just to stay aboard one of the ornery critters, and you have to be smart to stay alive when a Zero glides down your phosphorescent wake to strafe you. But there are compensations in the satisfying blast of a torpedo made in U.S.A. cutting an enemy ship in two, and in daytime fishing, hunting and swimming parties at a base in the South Sea islands that would be Paradise in peacetime. Read the story of the PT cowboys in the next issue.

The Battle Against Bacteria

FEW moments in the world's history have encompassed as many great medical discoveries and developments as this war period. Staggering as the war's cost in life will be, it is undoubtedly true that far more lives will be saved by advances in medical science hastened by the emergency. Lifesaving germs from the soil, penicillin and the sulfas, the electron microscope, germ-killing sound waves and sun rays, these and other developments are discussed in an important article in November.

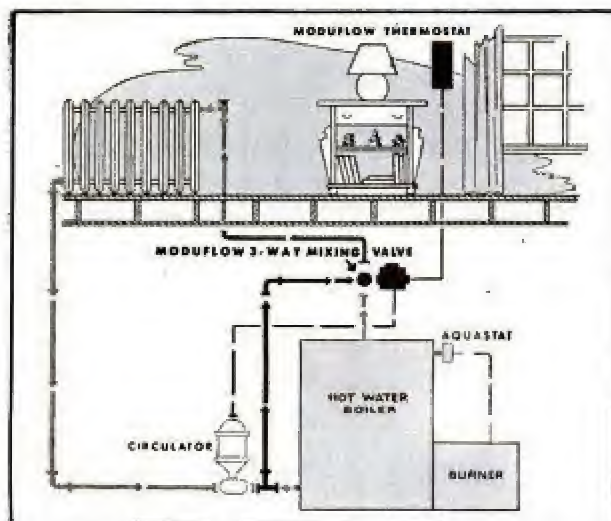
Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago (11), Ill., U. S. A. Single copy in the United States, 25 cents; subscription rates in United States and possessions, and countries of the Pan-American Postal Union, 1 year, \$2.50; 2 years, \$4.50; 3 years, \$6.00. Single copy in Canada, 30 cents; subscription rates, 1 year, \$3.00; 2 years, \$5.50; 3 years, \$7.50. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 60 days in advance so you will not miss an issue. Give both old and new addresses. Entered as Second Class Matter at Post Office Dept. Canada, the Post Office at Chicago, Illinois, under Act of March 3, 1879. Copyright 1944, by Popular Mechanics Company. Copyright under International Copyright Union. All rights reserved under Pan American Copyright Union. Printed in the United States of America.

Moduflow

HONEYWELL'S Amazing New Control System will Revolutionize Home Heating

NOW you can end the discomfort of ordinary "on and off" heating systems. No longer need you swelter, then freeze . . . For Minneapolis-Honeywell engineers have perfected a marvelous new system of heat-

ing controls. It is called MODUFLOW — heat *modulated* to just the right degree with a uniform, continuous *flow*. It is the exact opposite of the intermittent heat supply of conventional heating systems.



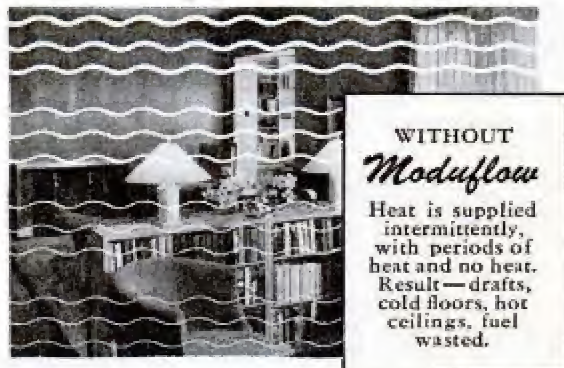
HERE'S HOW *Moduflow* WORKS

Moduflow is a simple, but ingenious, arrangement of controls that operates on an entirely new principle. It can be used with any type heating plant, hot water, warm air or steam, and with any kind of fuel. The diagram illustrates a hot water system. The solid black lines show the simple changes required. The hot water or steam is tempered at the boiler by means of a "by pass" line and mixing valve, to just the degree required by outside weather conditions. Heat is furnished *continuously* at the command of the modulating thermostat. Room temperatures vary only a fraction of a degree from high to low, and are uniform from floor to ceiling.

LISTEN . . . *The Blue Jacket Choir with Danny O'Neil*
every Sunday 12:15 to 12:30 A. M., Eastern War Time
over Columbia Broadcasting System.

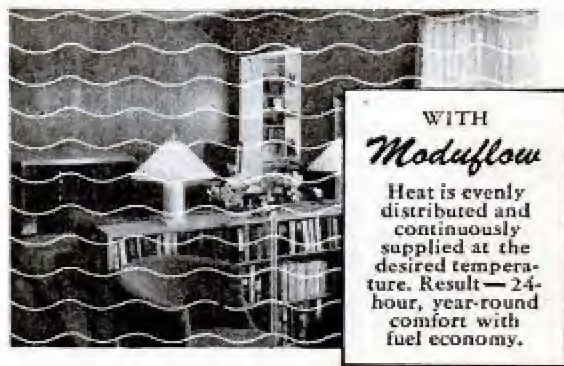
MINNEAPOLIS
Honeywell
TEMPERATURE CONTROLS

Makers of the famous M-H Electronic Autopilot, used on AAF 4-engined bombers



WITHOUT *Moduflow*

Heat is supplied intermittently, with periods of heat and no heat. Result — drafts, cold floors, hot ceilings, fuel wasted.



WITH *Moduflow*

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MODUFLOW IS NOW AVAILABLE for only a limited number of homes. Before you make plans to build or remodel, be sure to investigate Moduflow. Send for the illustrated Booklet: "Heating and Air Conditioning the Postwar Home." Just mail the coupon.



Free! SEND FOR THIS BOOKLET

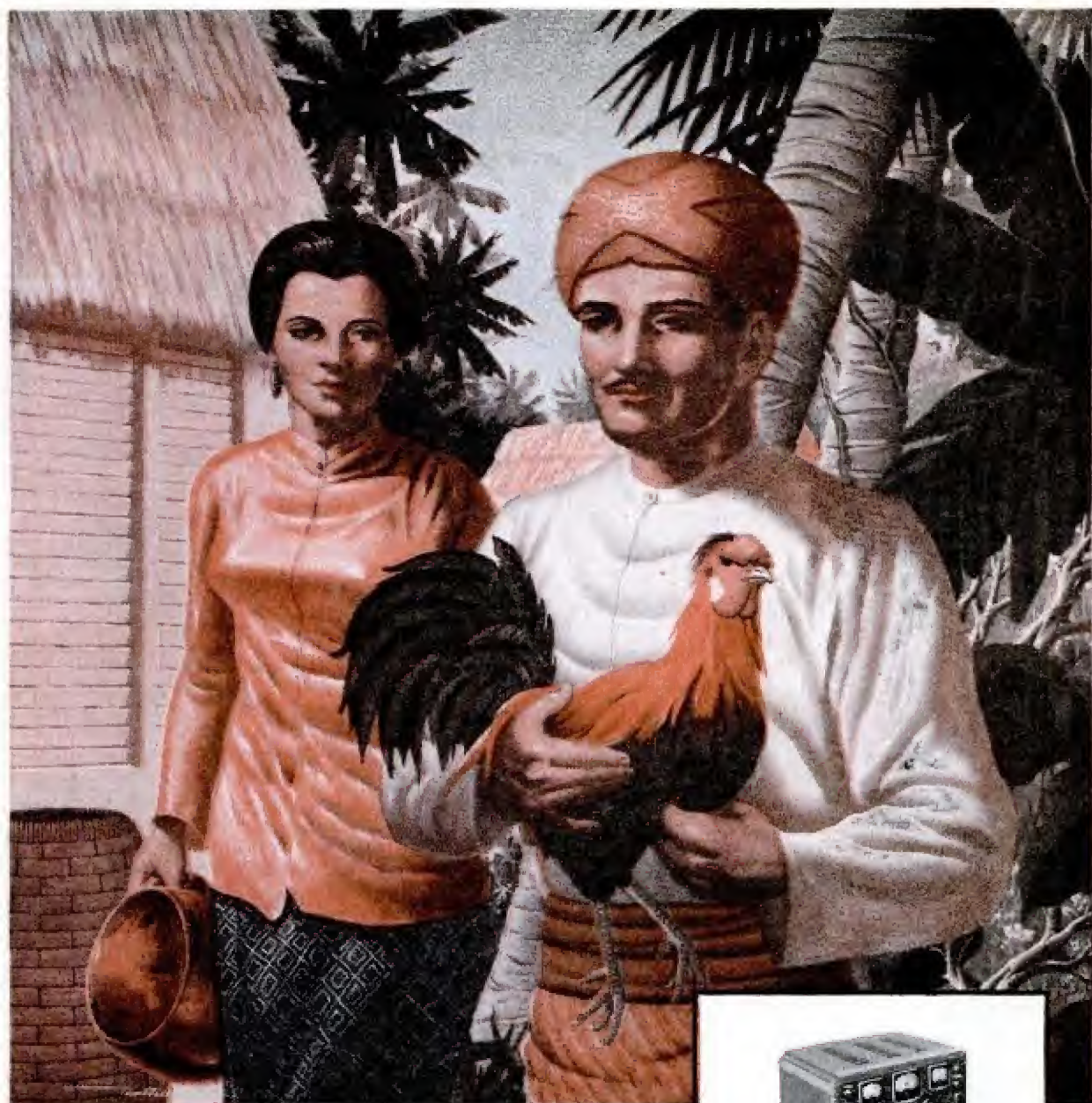
Minneapolis-Honeywell Regulator Co.
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Minneapolis 8, Minnesota

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Here is a Hallicrafters 15 tube, six band communications receiver with an amazing range and capacity. Right now all of Hallicrafters production goes into war communications equipment. But the time will come when you can own a set like this. Keep an eye on Hallicrafters to keep you in touch with the exciting new world to come. THE HALLICRAFTERS COMPANY, Manufacturers of Radio and Electronic Equipment, Chicago 16, U. S. A.

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AND HOLD THEM

SAFETY FROM START TO FINISH!

G-E MAZDA SEALED BEAM LAMPS

GENERAL  ELECTRIC

SEE WHY

it means safer night driving for you



LIGHT OUTPUT



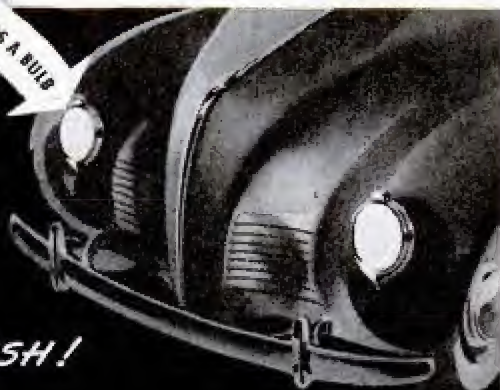
G-E MAZDA SEALED BEAM WHEN NEW 100%

G-E MAZDA SEALED BEAM AT END OF LIFE 99%

Here's a picture of the performance of an average G-E Mazda Sealed Beam lamp, based on years of road and laboratory tests. Up to the very end of life, it gives you 99% of original light!

SAFETY from start to finish! That's what General Electric Lamp Research has given you in the amazing G-E "All-Glass" Sealed Beam lamp...*the lamp that does not grow dim!* The whole thing is a rugged, hermetically sealed bulb which air, dust and dirt cannot penetrate. The reflector *never* tarnishes.

Play safe! When a headlamp burns out, replace it with a G-E "All-Glass" Sealed Beam lamp. You can use G-E Sealed Beam lamps in *any* car that has a "sealed beam" headlighting system. And for most pre-1940 cars sealed beam adaptors are available. Ask your service station, garage or dealer for G-E Sealed Beam lamps...the lamps that do not grow dim!



*Near the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m., EWT, NBC; . . . "The World Today" news every weekday 8:45 p. m. EWT, CBS.

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after the WAR!

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- ☐ Stenotypy; machine shorthand

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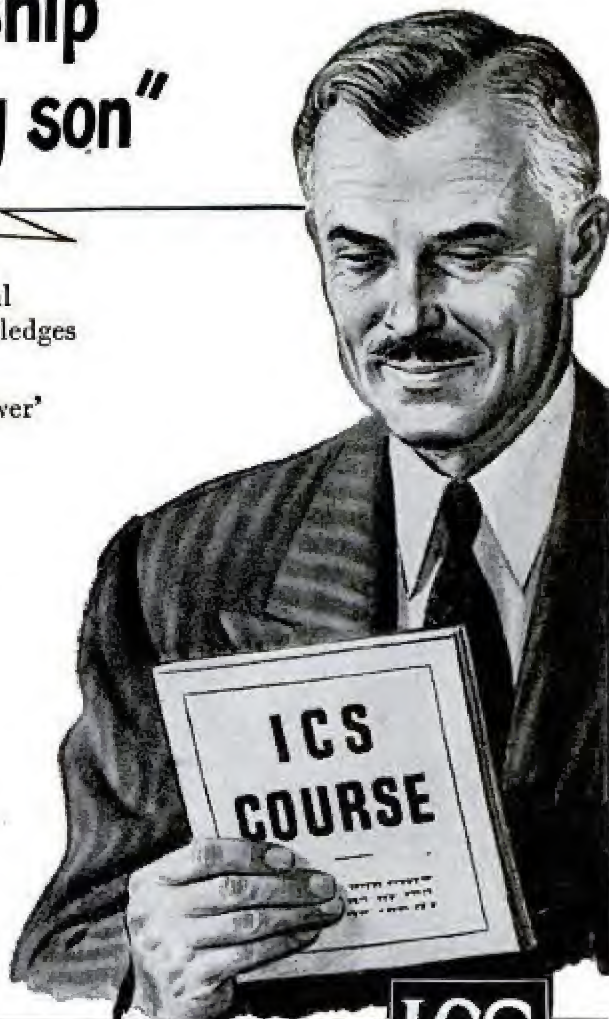
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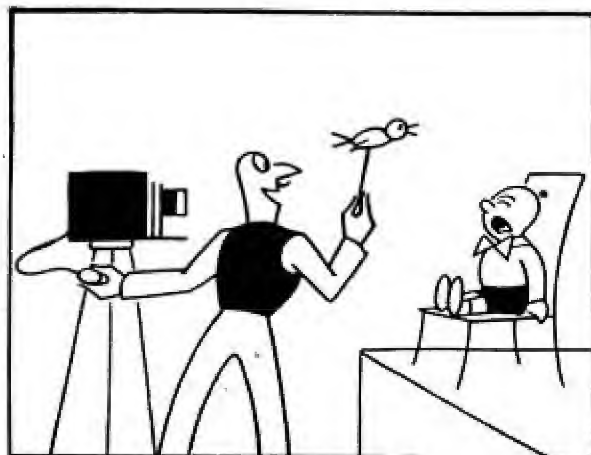
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O. SOGLOW

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described in order to avoid possible liability for patent infringement.

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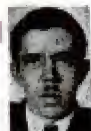
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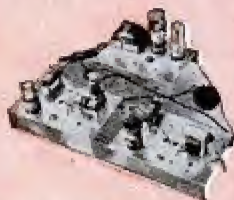
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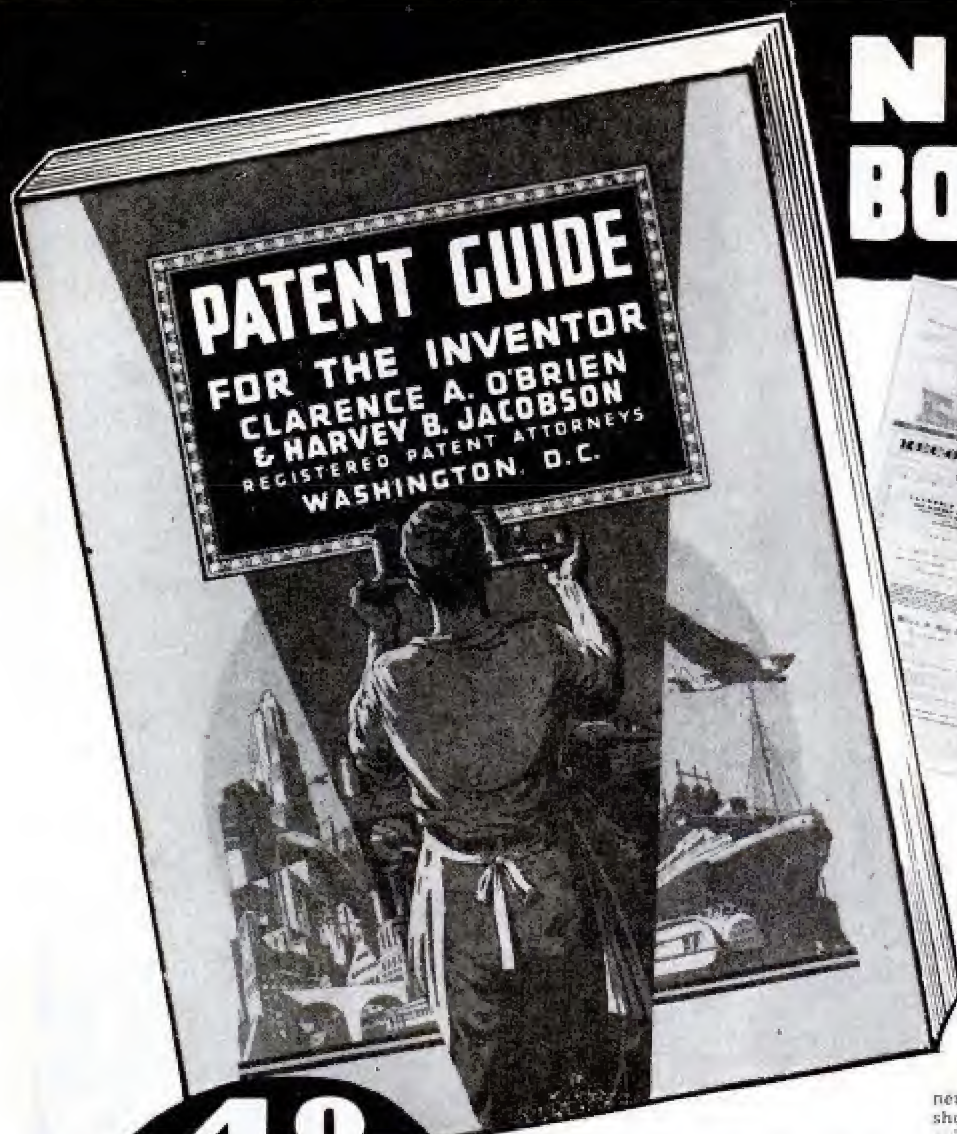
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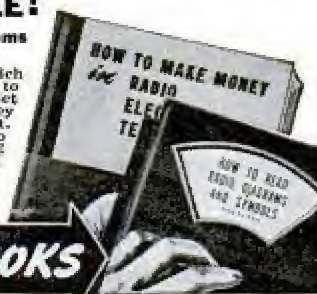


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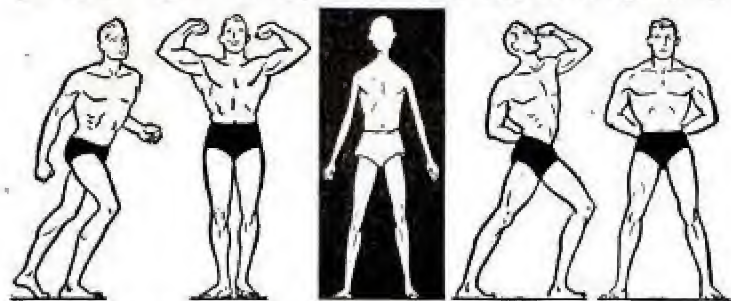
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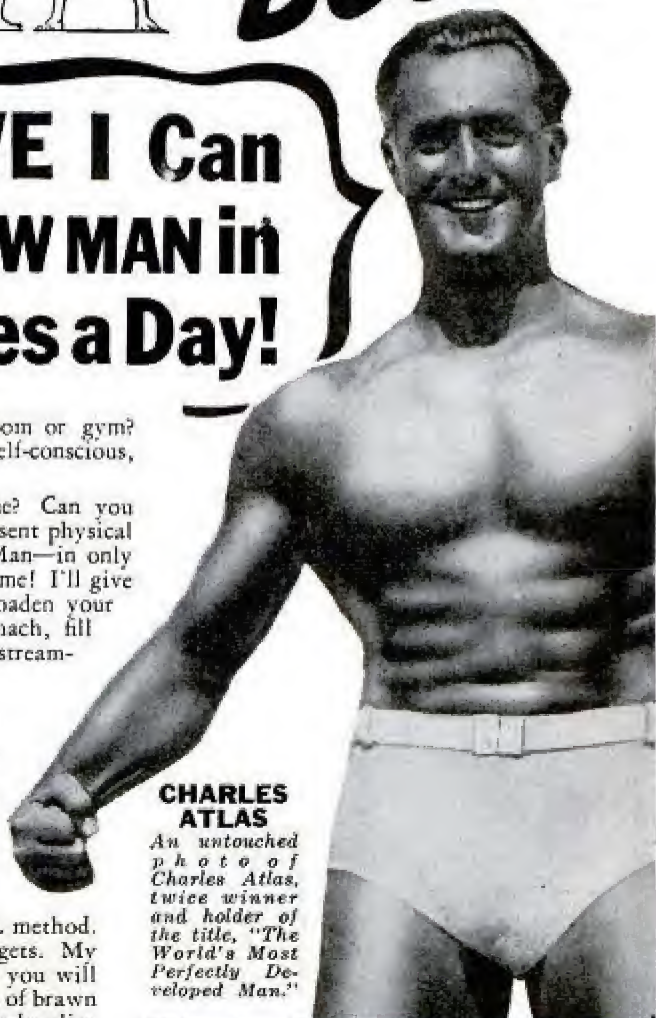
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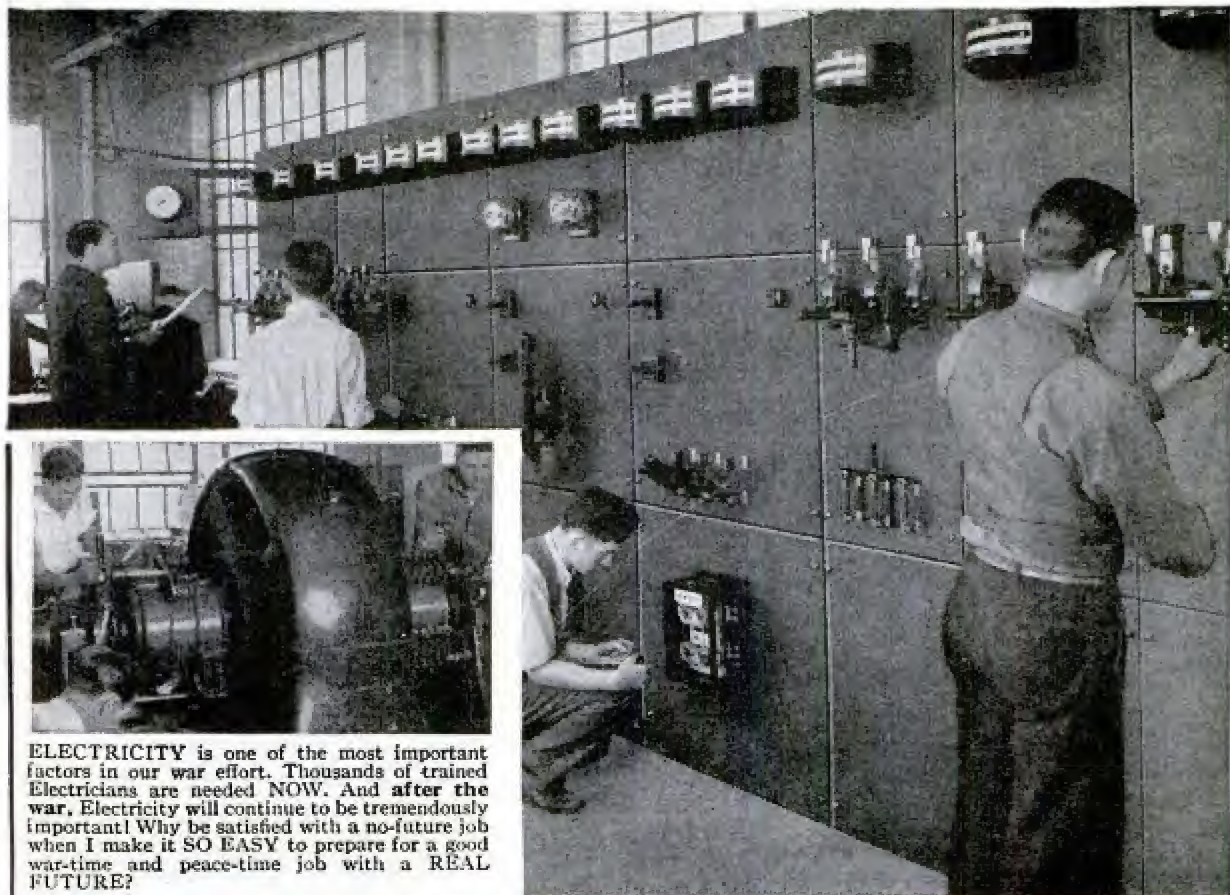
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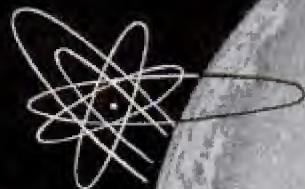
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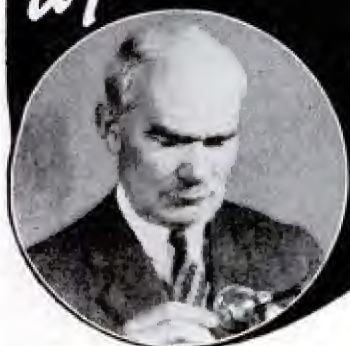
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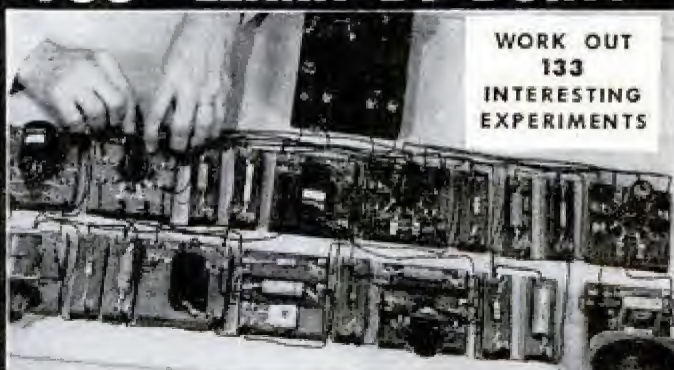
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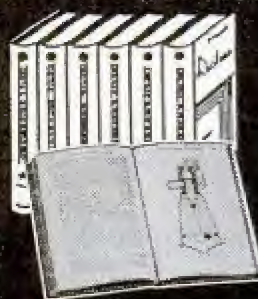
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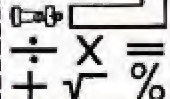
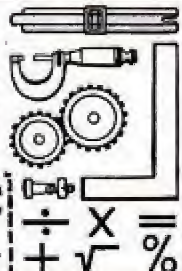
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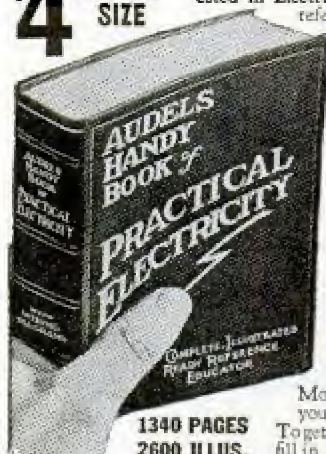
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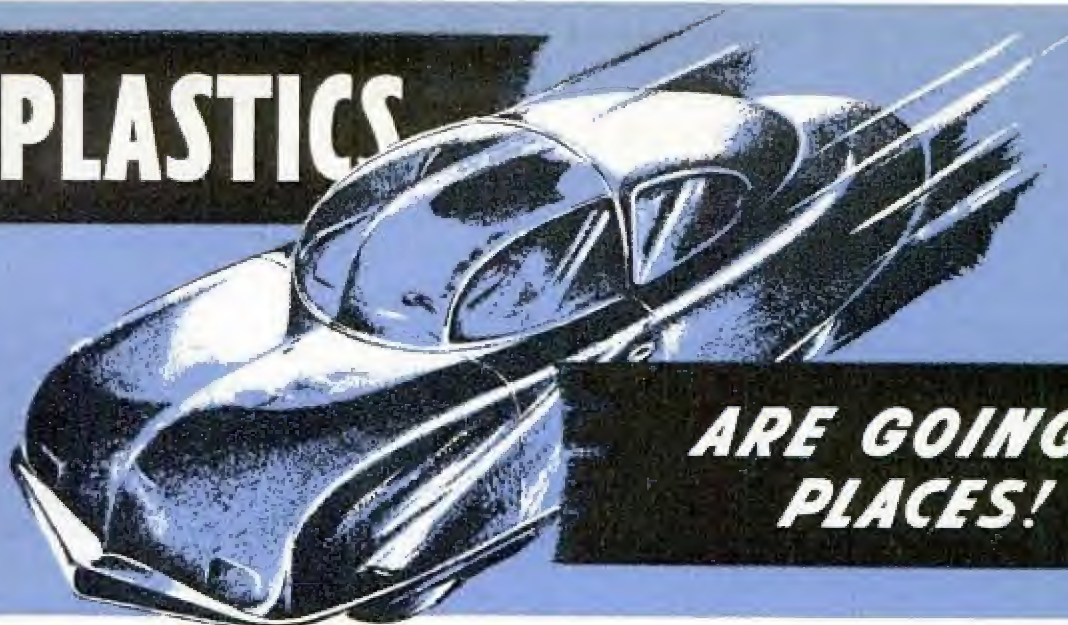
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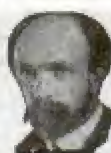
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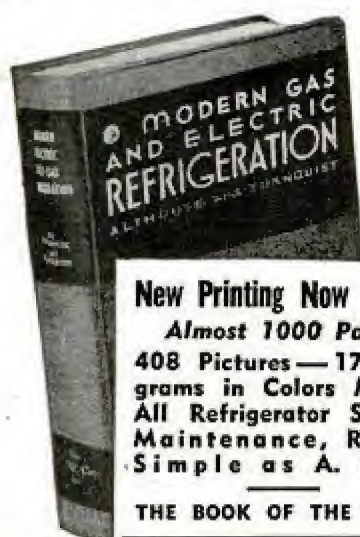
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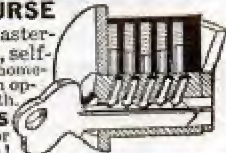
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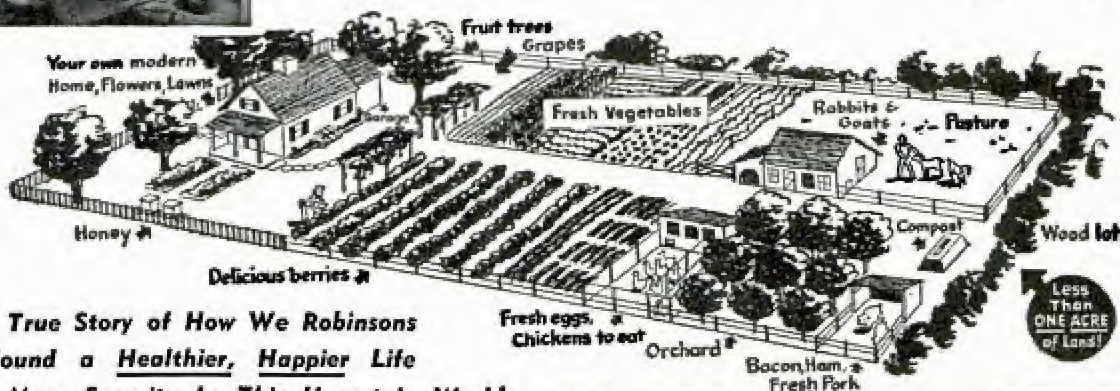
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If you work short hours, such as 40 hours a week or less, you can get all the more benefit out of the Plan. Perhaps in your work you have several days a week free or perhaps several weeks or months a year free. If you have a place like ours you can invest that free time in your own future security.

If You Are Planning to Retire:

Or if you are already retired, you can see that this Plan is a very practical way to stretch your retirement income and to help keep yourself in better health. This way, if you are going to receive Social Security benefits, or with just a small pension or annuity, you can look forward to many years of happiness and security. We've heard from lots of folks from Vermont to California who are doing just this right now!

If Your Income Is Limited:

This Plan is all the more for you if your income is limited. You can start with as little as \$30 cash.

Honestly, this Plan can be the way for you to have more of the really worthwhile things in life—if you'll just turn loose and get started! So sit down this minute and write me. Just put a dollar bill in an envelope with your name and address.

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LOT'S MORE

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If You Already Have a Place

Maybe you'd like to "compare notes" with us. Our Plan is laid out step-by-step, subject-by-subject, with lots of actual photographs of our place, diagrams, charts, tables, drawings. It shows how we do things the easiest, latest, most practical and scientific ways we can find. Who knows, maybe we can show you some short cuts, new methods, help you get better results. Just one new, good idea would be worth a lot more than the price of the whole Plan—and you'll have a lot of fun comparing your methods with the way we do things!

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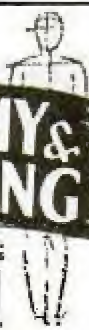
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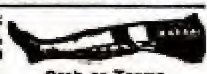
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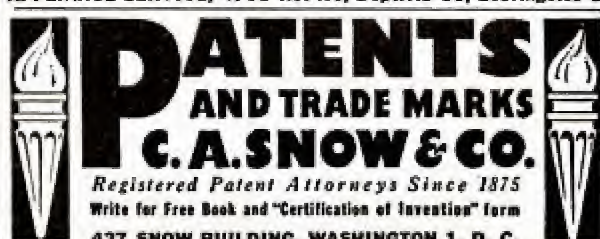
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SONGWRITERS Are offered rare opportunity to collaborate with hit composers on percentage basis through phonograph record manufacturer. Submit poems for approval. Recola Recordings, Hollywood 28, Calif.

SONGWRITERS—Free booklet "Getting Ahead in Songwriting." Write today. Song Service, 331-C West 46th, New York.

LEARN Piano. One hour. Free literature. Ferris, 317A So. Hartford, Bremerton, Wash.

SING Beautifully. Modern voice culture. Literature free. Ferris, 317A So. Hartford, Bremerton, Wash.

SONG Poems wanted. Free examination. McNeil, Master of Music, 510-PM South Alexandria, Los Angeles, Calif.

ACCORDIONS. New and used at wholesale prices. Save up to \$100.00. Buy direct from factory. Del Principe, 307 So. Wabash, Chicago.

SONGWRITERS Wanted: prices, details, free book. Variety, 2 Salem, Ind.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub Co., 201 N. Hoyne Ave., Chicago.

SONGWRITERS—Send poem for immediate examination and free rhyming dictionary. Richard Brothers, 24 Woods Building, Chicago.

SONG Poems wanted: Write for free instructive booklet, outlining opportunities. United Music Corporation, Dept. 14, Salem, Indiana.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

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PLAYERS, Victrolas, phonographs (mechanical) repaired. Epstein's, 50 First St., New York 3, N. Y.

RADIO Parts. Surprise packages. 100 pieces \$2.00. R. H. Lab, 3928 Dumaine, New Orleans, La.

TUBELESS Radio made with razor blades! Complete plans, 35c. N.W.A. Radio, Lohrville, Iowa.

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SUBSTITUTION Instructions. 200 critical tubes \$1.00. Jones, 1210P Dudley, Utica 3, N. Y.

LEARN Radio code; make simple, inexpensive practice outfits, send 50c for complete plans and large self instruction code manual. Ricou, Box 712, Pittsburgh, Pa.

MAKE Simple, tubeless, batteryless, distance-getting crystal radios, crystal and illustrated instructions. 25c postpaid. Allen, P-427, Clinton, Missouri.

RADIO Tubes, parts, condensers. Free bargain lists. Potter, 1314 McGee, Kansas City, Mo.

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RADIO Service men and experimenters send for our giant radio catalogue. Save dollars. United Radio Co. (1000M), Newark, N. J.

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NO Matter what you have to offer, a personal office in New York, under your own name (no care-of required) is bound to increase your business. Rates \$1.00 monthly or \$7.50 yearly. Co-Operative Offices, 128 Lexington Avenue, New York.

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MAKE Fast selling products at home. No machinery. Wonderful profits. Literature free. Kemico, 16, Park Ridge, Illinois.

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PLAN Now for a successful postwar business of your own. We tell you how to start, what will pay, what to sell, who will buy. Information free. Great Lakes Distributors, Box 97, Flint, Mich.

MAKE And mold genuine plastics. Forty illustrated work sheets explain methods, processes. Authentic—simplified. \$1. Free circular. Research, 3937B Tracy, Kansas City, Mo.

MAKE Girls novel name pins, simple, low cost. Complete instructions 25c. Melco Novelties, 323 Hayward St., Woodstock, Ill.

FREE Details how to co-publish your own magazine. Sample dime. Victory, 106 Penn. Dowagiac 1, Mich.

GET Into victory and prosperity. Local or mail business. Make 300% profit. Dime brings proof. Central, Simpson 1, Kansas.

REPAIR Home appliances: Learn to repair appliances with simplified instructions. Send 50c, stamps, coins or will send c.o.d. plus post. Acme Press, Box 182, Chicago 17, Ill.

SELL By mail. No waiting. We help you start making big profits immediately. Send \$1.00 only. Satisfaction assured. Moneyback guarantee. United Profit Builders, 305 West 8th St., Los Angeles 14, California.

"INVENTION" Simple to build, Great demand. 300% profit. Small capital. Saves customers thousands. Plans, instructions, permission to manufacture \$26.00. Information 25c. Cash Inventor, Box 416, Chula Vista, Calif.

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MAIL Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-snatching schemes. New success-catalog free! Write Nelson Company, Dept. 4-02, Chicago 4.

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YOU Can make fancy profits selling flavoring extracts. Make your own. Send two dollars for each formula. Your Service, Box 643, Warren, Ohio.

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LIQUID Marble; snow-white, multi-colored. Glazed. Unglazed. Composition flooring. Lifetime wear. Any color. No priorities. Flexible molds. Plaster casting. Get into the big money now. Full information given free. Write Compo-Tex, Box 786-R, St. Louis, Mo.

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MAKE, Sell sparrow traps that will catch thousands. Complete, illustrated plans \$1.00. Money back if not satisfied. Roy Vail, Howe 20, Ind.

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BUSINESSMEN! New method saves bookkeeping expense. Details free. Anderson Sales, 101 Park Ave., New York.

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YOUR Own business, spare or full time. Information stamp. Henry Schultz, Route 2, Pascagoula, Mississippi.

MAKE Sell, cosmetics, perfumes, household specialties. 110 formulas—50c. Hanson, 380 Third Ave., New York City.

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BE Independent, start paying business in your home with our tested plans. Free descriptive booklet. Applied Industries, 953-M East Michigan Ave., Ypsilanti, Michigan.

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INFORMATION — Locating articles wholesale, etc. (Quarter). Rakes, M-35 So. Halsted, Chicago 6.

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I MAKE Big money in the mail-order business. You can do the same at home with my copyrighted system. Write me. I'll tell you how. F. Little, Box 8, Glen-shaw P. O., Pittsburgh, Penna.

OPPORTUNITY Seekers packet big mail 10c. Worrock, Room 438-X, 2051 Telegraph Ave., Oakland 12, Calif.

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START Today profitable repeat M.O. business. 25c coin brings proven details. B. Benson, 8040 Rindge, Venice, Calif.

127 WAYS To build your own business at home, or small office. Details free. Victory Publications, Box 179E, Dowagiac 1, Mich.

FREE, "Mail Order Trade Directory," given with, "If It's Wealth You Desire," book with a guide to financial independence, \$1. Morgan, 114 Callaghan, San Antonio 3, Texas.

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GROW Dwarfed trees few inches high for yourself or sell. Instructions 15c. Charles McGuire, P.O. Box 628, Dept. G, Seattle 11, Wash.

EASILY Made gasoline gas machines as well as other types (septic, reformed gas, etc.), 5,000 word booklet \$1.00. Gas rate for heating and cooking as low as 30 cents. Ideal Spec., Lakewood 5, Rhode Island.

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PERFUME Instructions furnished. Start mail order or local business. Particulars free. Dr. Abell, Parkway Bldg., Pasadena, Calif.

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PUBLISH Your own magazine. Hand-some 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits, 10c brings sample, details. National Ord. Nebr.

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BUILD Your own crack proof concrete walls for anything. Plans \$1.00, or money order. W. Denham, Box 1382, Durham, N. C.

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RELIABILITY. Any formula 50c. Thorough research. Excellis Products Company, P.O. Box 3198, San Francisco 19, Calif.

ANY Formula \$2.00 or money back. Case Kowal, Chemist, 1846 Cullerton, Chicago.

FORMULAS—Latest, best. Analysis. Literature free. Belfort, Engineering Building, Chicago.

AUTHENTIC Formulary. 924 page illustrated book. Prepared by experts. 10,000 practical tested formulas, recipes, secrets, instructions for easily making most any product. Countless profitable business opportunities. Valuable reference for home, industry. \$2.00 post paid (c.o.d. U. S. only). Foreign \$2.35. Adams Brown Company, Dept. 11, Chestnut Hill 67, Massachusetts.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse, N. Y.

CHEMISTRY

LUMINOUS Paints, ready-mixed, five colors phosphorescent \$1.00. Five colors fluorescent \$1.00. Each color covers six to ten square inches. Card showing the ten colors on inch squares 25c. Catalog of electrosopes, spectroscopes, radium paint, U. V. lamps, etc., free with above. Catalog alone 10c. Hammer Laboratories, Denver 7, Colorado.

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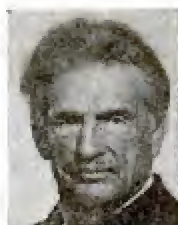
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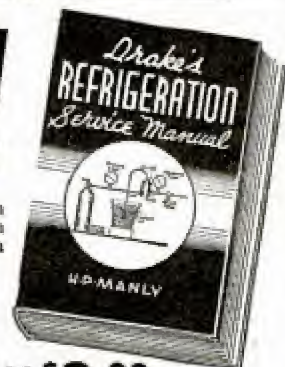
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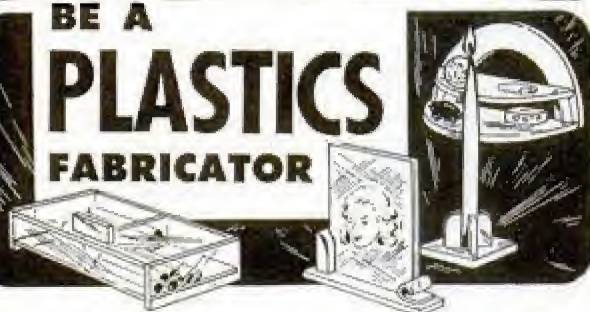
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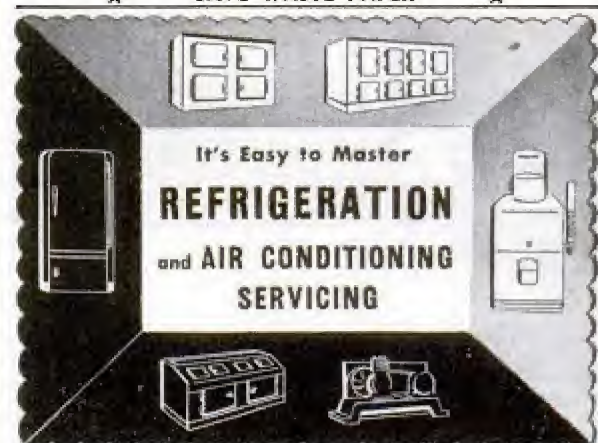
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"You'll Go Places On This Team!"

1st Lt. Richard J. Niederriter, pilot, 1st Lt. Richard A. Carocari, navigator, Sgt. Richard W. Evans, tail-gunner, and 1st Lt. Lester A. Darst, bombardier, (left to right in foreground above) have hit most of Germany's "hot spots" in their Flying Fortress, the "Winsome Winn." Asked which was their most exciting mission, their answer was unanimous: "Anklam!"

"You probably never heard of Anklam," Lt. Carocari said. "Before the war it was just a little jerk-water town a hundred miles or so from Berlin. But the Nazis built a Focke-Wulf assembly plant there. And our assignment was to flatten it."

"I plotted my course for Berlin, to make Jerry think that was where we were heading. And we hadn't any more than crossed Denmark until the reception committee buzzed out to meet us. At least 300 German fighters hit our flight. They'd come barreling in from all directions at once . . . the fire from their cannons and machine guns making a solid sheet of flame along their wings. The going was hot and heavy for awhile."

"Hot and heavy is right," Lt. Niederriter said. "We were under fire for 3½ hours. But our gunners were too smart—and too good—for them. Evans here had his tail-gun knocked out, so he came up and fired the flexible gun in the nose. When the ball-turret got fouled up with oil from a damaged line, the ball-gunner adjusted it so it would keep revolving—to fool the fighters—and then he climbed out and lent a hand at the waist-guns. It was the prettiest piece of teamwork I've ever seen."

"That's what really licked 'em," Sgt. Evans said. "Teamwork! Lt. Niederriter had his hands full keeping the Winsome

Winn on her course . . . yet all the time, he sat up there and called the shots for us gunners. We sure did work those German fighters over. We saw two blow up in mid-air."

"Finally," Lt. Darst said, "we changed our course and cut for Anklam. The F-W's gave us a breathing spell as we swung in over the town and we made a nice, smooth bombing run. I saw our eggs land square on that factory. And, brother, did we plaster it! They won't make fighter planes there very soon again!"

Lt. Niederriter grinned. "Sure," he said, "you go plenty of places in the AAF. And it's not exactly joy-riding, either. But we've got a job to do. And we work together to do it."

"And I think that's the important thing for any young fellow—who wants to win his wings as Gunner, Bombardier, Navigator, or Pilot—to remember . . .

"You're on a team in the AAF—from the time you step into your first training plane until you get up there in action. And it's a winning team . . . an unbeatable team . . . the 'greatest team in the world!'"

U. S. ARMY RECRUITING SERVICE



"They came barreling in from all directions."

MEN OF 17...



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your aptitudes are outstandingly high, you will be trained as a bombardier, navigator or pilot, and upon successful completion of training, will be graduated as a Flight Officer or Second Lieutenant.

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0422

Vol. 82

OCTOBER, 1944

No. 4



By Rear Admiral
Clark H. Woodward

U. S. Navy

SPRINGBOARD for VICTORY

THE AMERICAN conquest of Saipan, because of its position in the strategic Marianas group of islands, was the greatest victory won by the Allies in the Pacific war. By the opposite token it was Japan's greatest defeat.

That the effect on Japan was paralyzing was proved by the overthrow of Premier Tojo and his cabinet, following closely upon changes of the Chief of Staff and Ministers of the Army and Navy. Such a shake-up in Japan's High Command was a public acknowledgment that the

Douglas Dauntless dive bombers of a task force that hit Rabaul crowd deck of Saratoga



*Industrial Incentive Div.
2118 Massachusetts Ave.,
Washington 25, D.C.*

OCTOBER, 1944

1



U. S. Navy photo

Grumman Avenger torpedo bombers (top) and Dauntless dive bombers roar above the ships of Task Force 58, that deadly combination of sea and air power that is sweeping the Pacific clean

previous cautious defensive policy of the Tokyo war lords was bringing ruin to the empire.

This was virtually admitted by Tojo when, upon reporting the loss of Saipan, by broadcast, he stated that "Imperial Japan has come to face an unprecedentedly great national crisis."

This was, by no means, an overstatement.

The loss or neutralization of the Marianas, the bombing of Japan's industrial centers by our Superfortresses, and the continuous loss and damage to enemy shipping inflicted by our planes and submarines have kept the Japanese public in a constant state of jitters.

A glance at the map shows how the conquest of the Marianas, planted firmly in Japan's inner defense area, 4,000 miles west of Pearl Harbor and directly on the road to the Philippines, fits into Allied strategy. These is-

lands, as intimated by Secretary of the Navy Forrestal, are the springboards for attacks by land-based and carrier-borne aircraft on the mainland of Japan, the Philippines and the major part of the Dutch East Indies. Also, they are the advance sea-air bases for reconquest of the Philippines and establishment of operational bases on Formosa, or the China coast, for air attacks



Beneath the big guns of a U. S. battleship the secondary battery lashes at Jap positions ashore

on Japan. From them Japan's sea communications to Malaya, the Dutch Indies and the Indian Ocean are directly menaced.

The map on page one shows five significant points:

1. About two-thirds of Japan, half of Formosa and all of the Philippines are inside the range of fleet air operations;

2. The same area, plus Borneo, is in the "possible radius of operations from Pacific bases of the newest U. S. bombers;"

U. S. Marines dig in on the beach of Saipan on the morning they established their first foothold

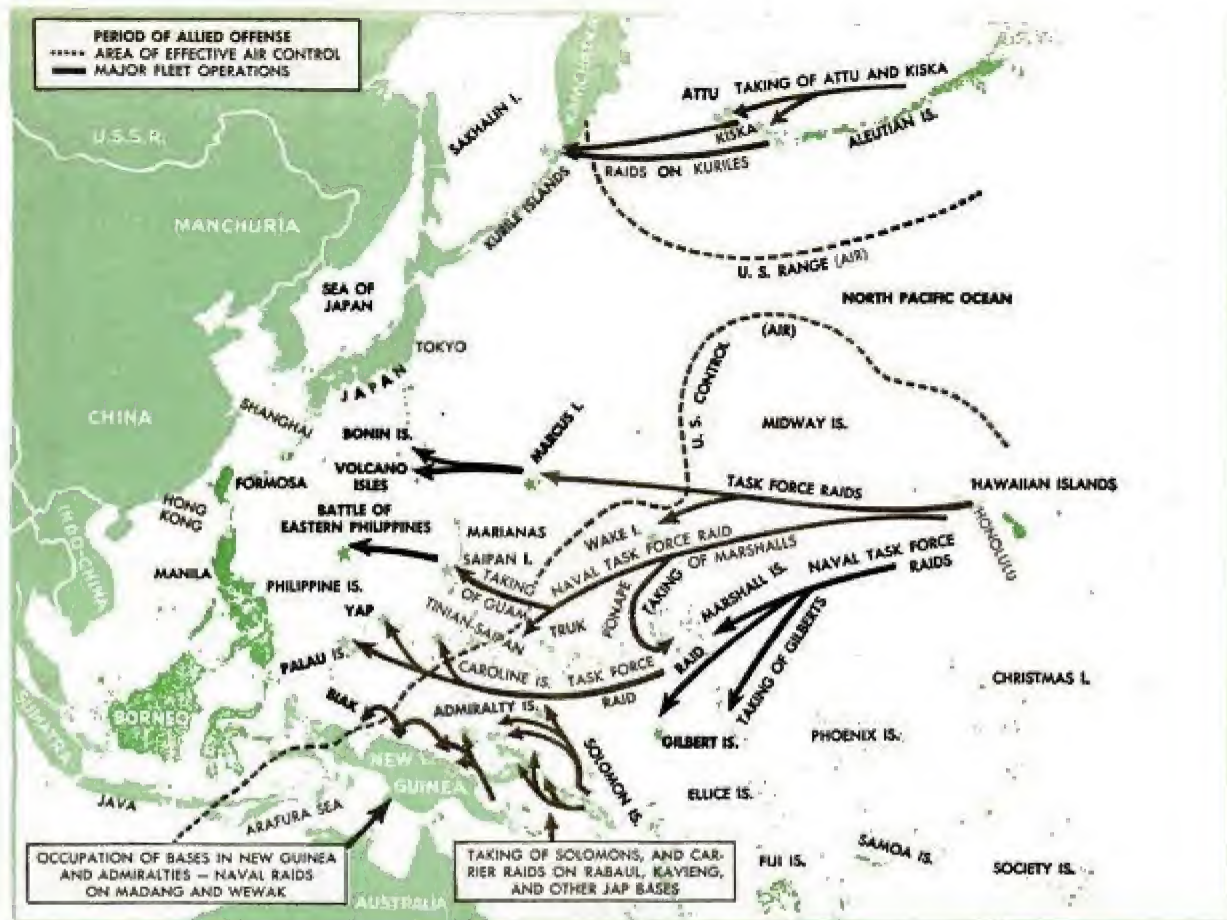


Above, continuous broadsides hit the Japs on Saipan during landing operations. Left, Navy chaplain conducts services for Marines who died in the assault

3. Additional area of Allied air operations as result of New Guinea advances and invasion of the Marianas, includes the Bonin and Volcano Islands and half of the Philippines;

4. Air control of the northern half of the Kurile Islands from Aleutian bases; and

5. Isolated pockets in the Central, South and Southwest Pacific containing 200,000 Japanese



The Navy map shows our task force raids and landing operations. Below, just out of range of Jap shore batteries, a U. S. destroyer transfers men wounded on Saipan by breeches buoy to a larger ship



"out of range of help from the homeland."

Since the Battle of Midway the face of the war in the Pacific, particularly in the central theater, has been transformed by the American navy. Its offensive strategy adheres to the tried principles of employing concentrated forces, with surprise tactics, against weak positions of the enemy. This has made possible the seizure of base after base from which our forces could press forward toward Japan's inner defense ring while neutralizing or bypassing other strongpoints no longer of great importance.

By this means our fleet, in less than a year, has gained more and more control of the Pacific until now it is at Japan's front door where her main battle fleet, hiding in home waters, can remain unchallenged by surface craft, and within protective range of her land-based planes.

The development of aircraft carriers has enabled our navy, by using its sea-air strength as a team, to conduct the offensive on a great scale and with unprecedented speed. The problem of waging war at vast distances in the Pacific has been solved by the Navy's self-sufficient task forces. Because of their accompanying floating bases—supply and ammunition ships, oilers, hospital



U. S. Marine Corps photo

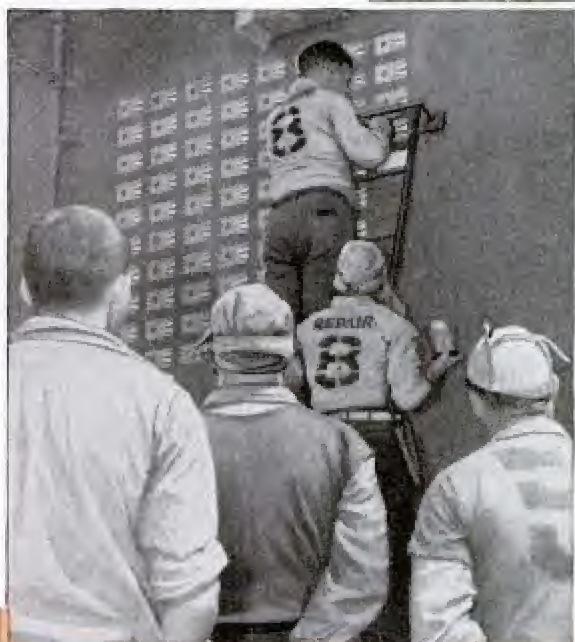
Tojo doesn't answer any more. Members of a Marine communications unit put to work a captured phone

ships, repair ships and other auxiliaries—task forces no longer depend upon shore bases.

Beginning with captured bases in the Gilberts, last November, successful operations and leap-frog jumps have carried our forces more than 4,000 miles from our main base at Pearl Harbor, and through the enemy's outer defense perimeter to less than 1,000 miles from Tokyo.

Continued to page 160

Left, crew of a flattop in Task Force 58 marks up another "rising sun" plane downed. Below, Marines clean guns and dig foxholes for first night on Saipan

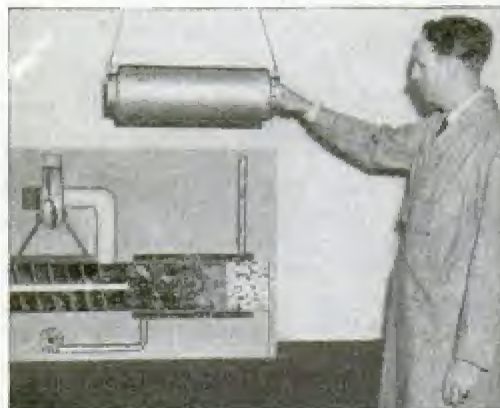
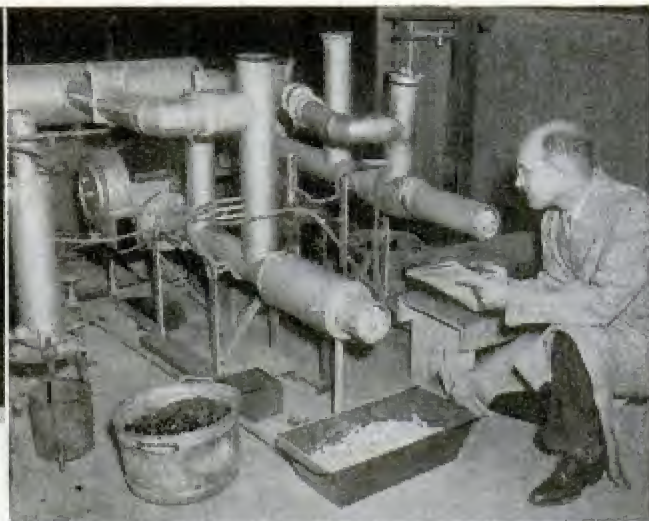


*N. W. Geyer & Son, Inc.
30 Rockefeller Plaza, N. Y., 20, N. Y. 0484*

Tiny Tube-Like Furnace Heats House in a Jiffy



The 75-pound tubular burner is dwarfed by conventional furnace. Right, conducting ash tests on two units. Below, cutaway of tube



Enclosed in space two feet square and three feet long, a revolutionary heating unit of tubular design burns anthracite to heat an average size home in 15 minutes. The burner weighs only 75 pounds. Coal is pushed

automatically through the tube, which is six or eight inches in diameter, with a screw-like worm. It is ignited in the center of the tube and the ash is discharged at the other end into a dustproof container. Air for the burner is supplied by a suction fan. Water or air, depending on the type of heating system desired, is circulated around the hot part of the tube in a compact jacket. This "capsule" furnace, which is said to do the work of a half-ton unit, was developed by Anthracite Industries, Inc., as a postwar project and no furnaces have been built for sale. The tubular design is possible for an anthracite burner, according to its inventors, because hard coal under proper condition can be made to burn within its own area. This eliminates the need for secondary combustion space. Less heat is said to be wasted in the midget furnace, and more of it goes into the water or air to be circulated.

Junior Jeep Becomes 'Fire Peep' to Replace \$10,000 Truck

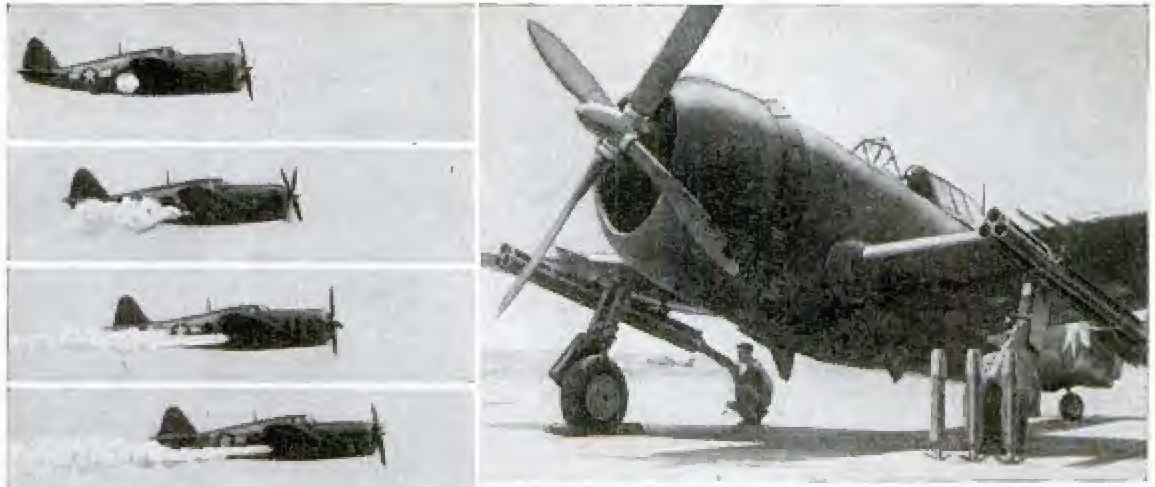


Under the label "fire peep," a \$600 junior jeep was remodeled by the fire department of the Indianapolis Naval Ordnance plant to replace a \$10,000 regulation fire truck, which was transferred to another naval authority. The hose reel and extinguisher cabinet were placed on a small trailer, while the peep itself was equipped with ladder racks, gas masks, electric lantern, mounting plates for nozzle tips and a cabinet for complete asbestos suit kit.

U. S. Navy photo
6
*Mr. C. N. Moore
1342 N. Dearborn St.
Chicago 10, Ill.*

POPULAR MECHANICS

Camera Catches Rocket Fired From Thunderbolt



Left, camera snaps rocket being fired. Above, crew loads rocket tubes before take-off

Complementing the vicious fire power of its eight .50 caliber machine guns, the P-47 now packs rocket armament. Three long thin tubes grouped underneath each wing are loaded with projectiles just before the Thunderbolt takes off for enemy territory. Other details of their operation remain secret.

0407

Nazi Tank Loaded With TNT Aimed by Remote Control

Captured intact in Normandy, a German remote control vehicle "B4," which looks like a small tank, carries on its front a detachable steel box container with a big

charge of high explosive inside. The box could be released from the vehicle, which is driven by a man to a safe spot, then guided by a remote control device to its target.

0480



An allied soldier inspects a remote-control "tank" used by Nazis

Near-Odorless Fly "Dope" Can Be Sprayed on Clothes

Used by the Army at the rate of thousands of gallons a month, an insect repellent that has little odor can be sprayed on clothes or applied directly to the skin. Clothing sprayed with two or three ounces of the water-like liquid keeps mosquitoes, flies, fleas, gnats, sandflies or chiggers away for about five days. On the skin, it is effective for one to six hours. The repellent, called dimethyl phthalate, was developed by the Dupont Company from a compound used in making synthetic resin. It is hailed as a successor to citronella.

W. L. Gump's Port Repair Ship



The Van Noy was virtually rebuilt inside and out. Everywhere there are reinforcing girders and double-riveted plates. At her bow is a steel cathead capable of lifting 40 tons. Mounted on her massive foremast are five booms, four of them 10-tonners, the other a 30-ton heavyweight.

The ship carries a complete 21-unit ponton system. When bolted together the pontoons have a lifting capacity of 50 tons. Obviously there will be need for such equipment in the postwar period, when the raising of ships torpedoed along America's coasts will in itself be a job of colossal dimensions.

The Van Noy has five divers. If they happen to be under water when an enemy attack begins, they can be rushed to the surface and placed in a recompression

Right, a diver comes up with pipe removed from harbor bottom. Debris-clearing is one of ship's jobs



Above, a soldier crewman wields a fire hose. Right, divers' recompression chamber to prevent the "bends"

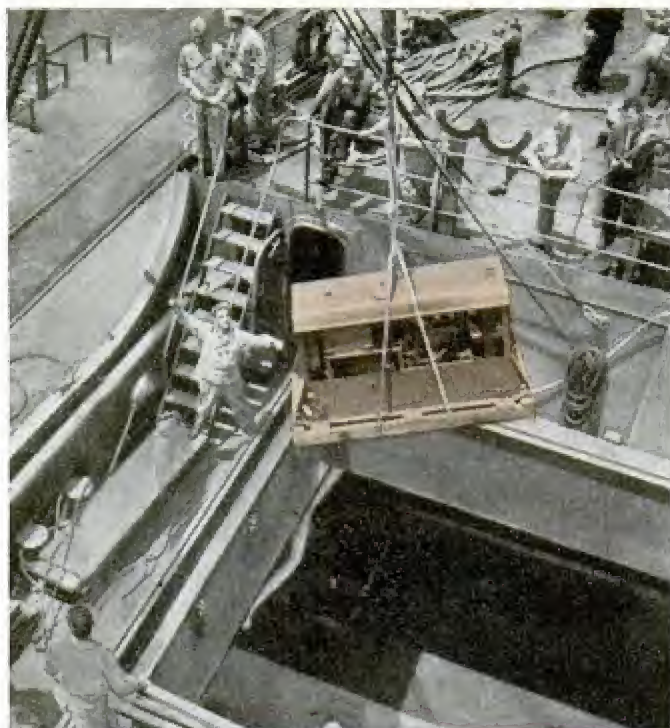
chamber. Thus they will escape the double danger of bends and concussion.

The jack-of-all-trades vessel can fight fires too. She carries four motor-driven pumps, each with a capacity of 3,000 gallons per minute. An eight-inch fire main is looped around the main deck. Eight hydrants are spaced handily throughout the ship.

If the Van Noy encounters harbor impediments which cannot be cut down or dragged away, her dynamite experts will take over. If she is attacked, her deck rifles and antiaircraft guns will sound defiance.

So many generators does she carry that if a town's electrical system were smashed the Van Noy could plug into the power





Generator being loaded aboard a "handy-andy" ship. The Van Noy carries enough generators to supply electricity to a town

lines and supply current until regular facilities were restored.

The men who sail this remarkable ship have backgrounds packed with adventure. Take the tough-skinned skipper, 50-year-

old Thomas J. Allison, for example. For 20 years he commanded everything from tankers to river scows. Between times he was a coal heaver, an actor and a newspaperman. In 1930 he quit the sea for a quiet shore berth at the Ryan Aeronautical Corporation in San Diego, California.

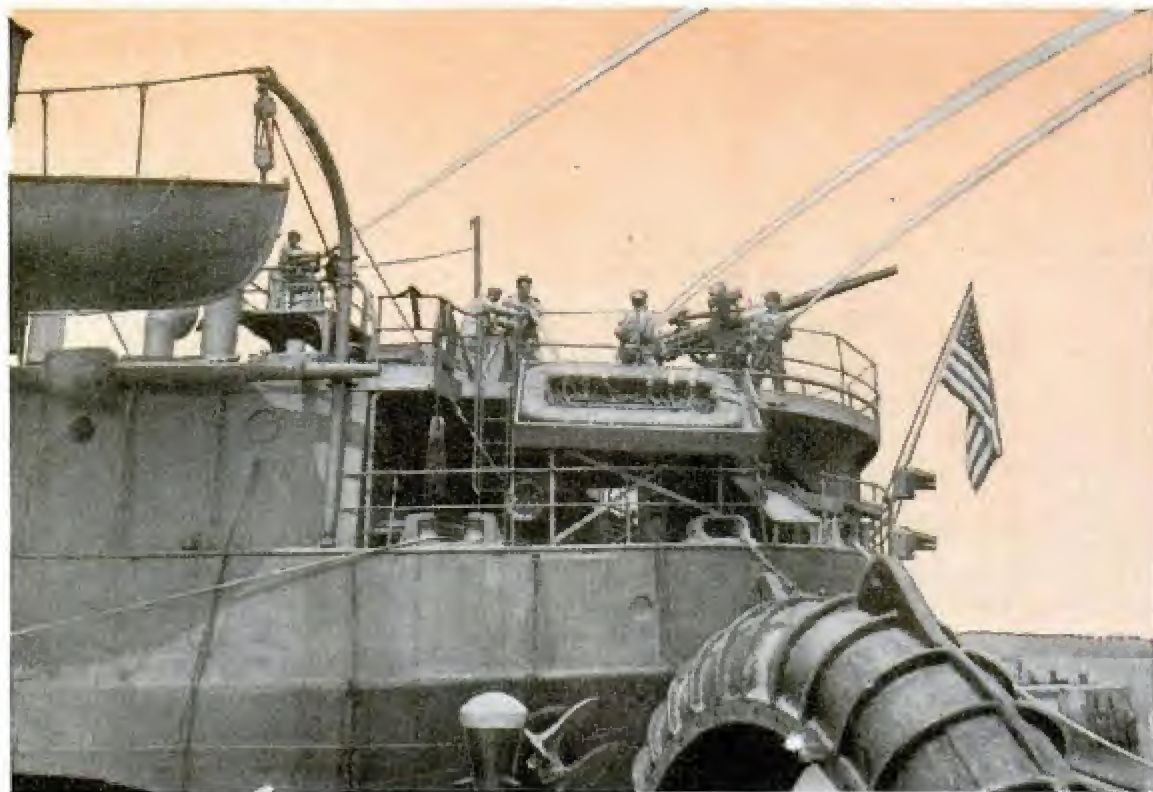
When the Army Engineers, having observed the devastation at Bengasi and Tobruk and elsewhere, decided on the handy-andy ships, they asked Allison to lend a hand. When they told him he would have charge of the Van Noy, which in years past he had known as the Covenia, he came out of retirement.

Allison was permitted to hand-pick his officers. From Trinidad he signed up Ralph R. Buscell, who as a Navy civilian employee had charge of 17,000 men and was earning \$1,000 a month. Now Buscell wears a captain's bars and is the ship's salvage wrecking officer.

Allison also lured into uniform, and a captaincy, George L. White, of Brooklyn, who was making \$700 a week with the Standard Oil Company of Venezuela. White became chief engineer.

From the salvaging of the liner *Normandie* came white-haired Austin George. He

Below, four of the Van Noy's hose lines in operation. She can pump 12,000 gallons of water a minute



sacrificed something, too: \$300 a week. Now, at 44, he is a warrant officer junior grade and the ship's chief diver.

Army specialist schools supplied most of the crew. All have undergone Army basic training and could hold their own with the best of infantry-drilled troops. They went through the Service Forces course at Camp Gordon Johnson, Fla., where units comparable to the Navy's Seabees are trained. Today only seven of the 56 enlisted men aboard are privates; most are technical sergeants.

During the calm-water shakedown cruise from Mobile, Ala., to Philadelphia, 49 of the "sailjers" became seasick. Gradually, however, they got the hang of things. Advice from the ship's Navy gun crew helps. No longer do the soldiers refer to a deck as a floor or to a companionway as a stair.

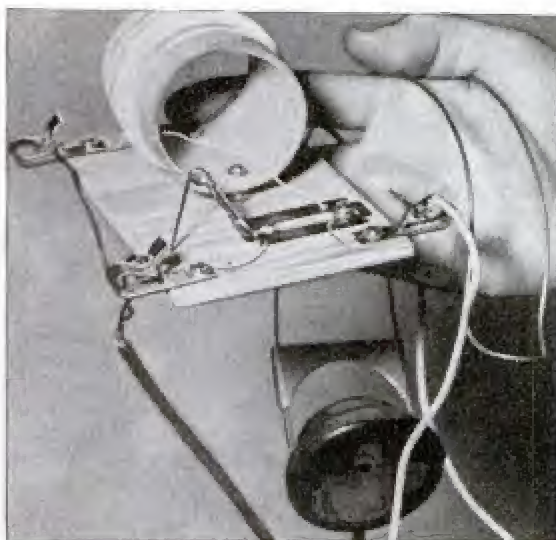
The men like to call themselves "Allison's Raiders." Although they wear regular Army uniforms, they occasionally don sailor hats just to add a nautical touch. Like all good ships, the Van Noy has a mascot, a puppy named Salty. He, too, has acquired his sea legs.



Above, the carpenter has plenty to do aboard this "mechanic's dream ship"



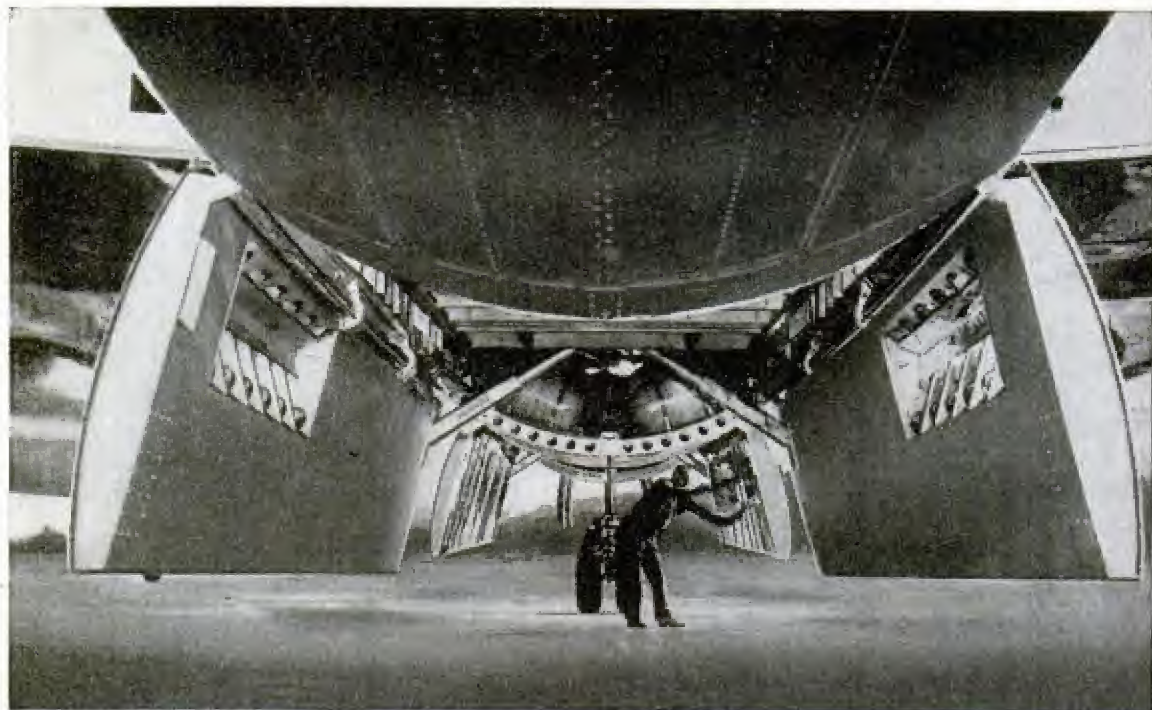
Two "Sailjers" team up for some electric welding on an emergency job



Radio Made Out of Razor Blade

Instead of discarding their used razor blades, American soldiers on the Italian front added a safety pin, a pair of earphones and a coil of wire with 120 turns and rigged up a radio receiving set to provide entertainment in their foxholes. The blued steel surface on a double-edged Marlin blade gave the rectifying action for detection of strong signals without crystals or tubes. The blade is tacked to a piece of wood with a wire taped to it and going to one side of the coil. The other side goes to ground and to one side of the headset. From the other side of the headset a wire goes to the safety pin, which is driven into the wood base at one end so the pin may be moved across the unground part of the blade to find your station.

Twin Bomb Bays of B-29 Keep Load Balanced ⁰⁴²⁵



So big are the bomb loads that Superfortresses drop on the Axis that two bomb bays are necessary to carry them. A mechanism releases the bombs alternately from the double bays. Since one bay is forward

Balancing
of the wing and one aft, the center of gravity is maintained and the flight of the huge ship is unaffected. The bomb capacity of the B-29 is still a secret but it is conceded to be larger than that of any other plane.

Aluminum Fins Add Horsepower to Aircraft Engines ⁰⁴⁰⁴

Using aluminum cooling fins on the steel cylinder barrels of Cyclone engines has enabled the Wright Aeronautical Corp. to add horsepower and at the same time save an estimated 24,000,000 pounds of highly critical alloy steel annually. Sixty fins are mounted on a barrel in the same space formerly required for 40 steel fins machined from the barrel wall. The combination of

steel and aluminum gives almost twice the cooling area of the all-steel fin. This advantage, plus the fact that aluminum dissipates heat more rapidly than steel, results in cooler operation, permits more power to be taken from the engine and adds life to piston rings. Known as the "W" fin, the device eliminates the difficult machining operation which used to be necessary to cut 40 narrow grooves into a solid steel barrel. It is produced by folding a strip of sheet aluminum into the shape of an extremely exaggerated letter "W." While this barrel reduced the overall weight of the engine by only one pound per cylinder, the saving in raw material is considerable.



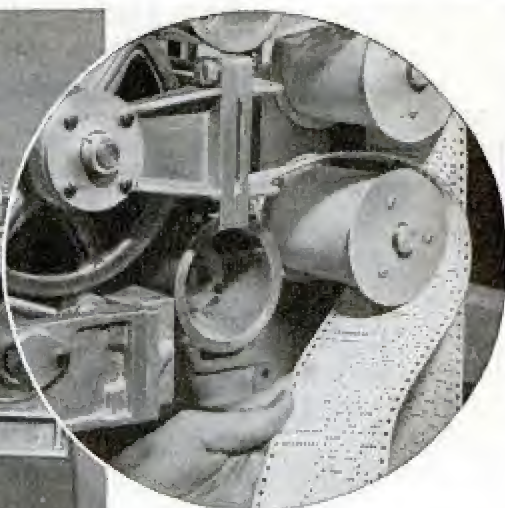
Worker compares the new fins (right) to the old type

Paper Is Ammunition—Save It!

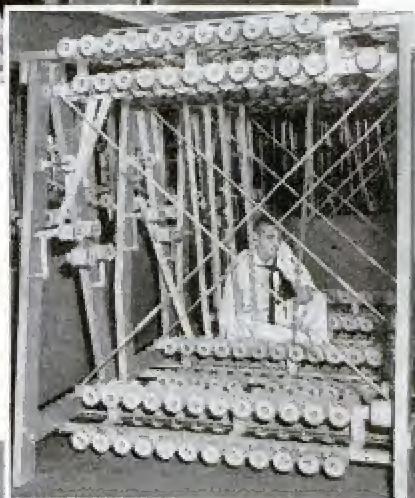
Any staff officer of the Army or Navy will tell you that fighting a war is a lot of paper work. That is a gigantic understatement. Paper is one of the most vital materials. Vast tonnages of paperboard are required for packing the guns and ammunition and rations for ten million fighting men. Paperboard is made from scrap: yesterday's newspaper, the contents of your wastebasket. Save your old paper for the salvage drive!

30 Rocky Mountain Alps N. Y. N. Y.

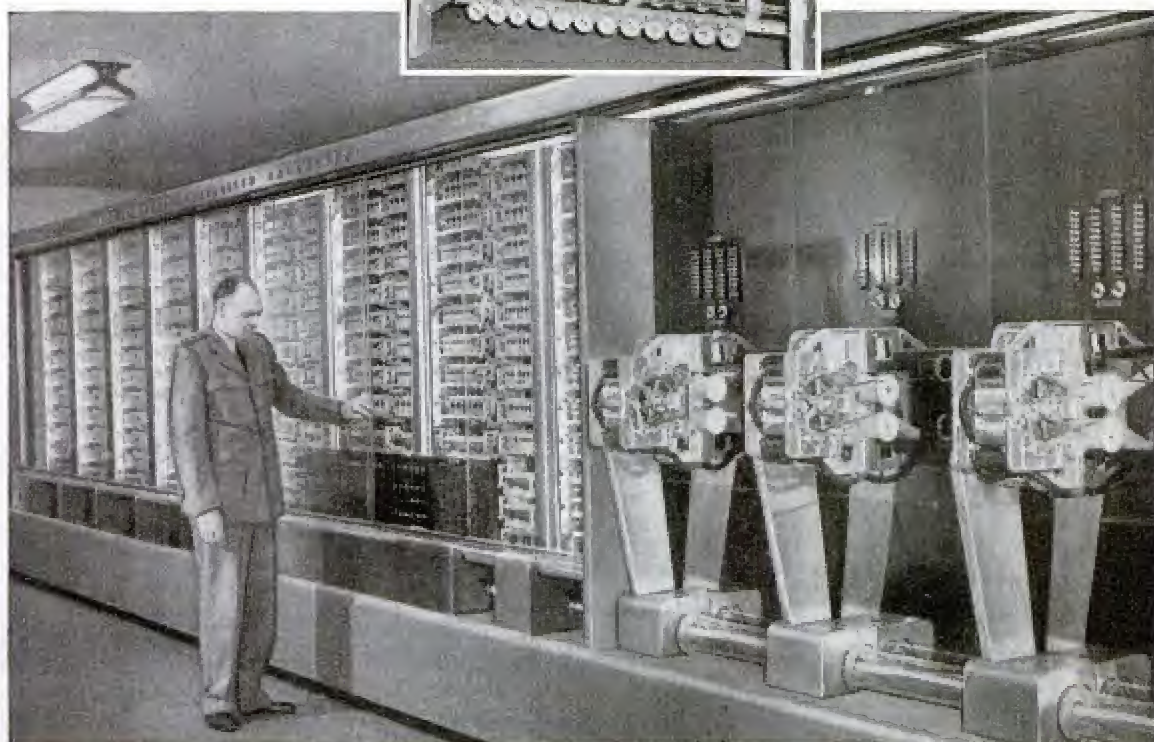
Robot Works Problems Never Before Solved



Solving problems which stumped mathematicians throughout history, is all in the day's work to the "world's greatest calculating machine" which gives accurate answers in 23 figures. Above, preparing a problem for the machine on manual tape punch which dictates operation of the "superbrain" with coded perforations. Center, system of holders on which tape moves



Above, tape entering sequence control mechanism shows how problem looks in "punch code." Below, general view of robot which is 51 feet long, 8 feet high. It has 500 miles of wire, 3,000,000 connections, tiers of 72 adding machines. Invented by Cmdr. H. H. Aiken, U.S.N.R., it was built by International Business Machines and presented to Harvard University for use by the Navy. After the war it will solve problems of star movements and algebraic equations hitherto unsolved



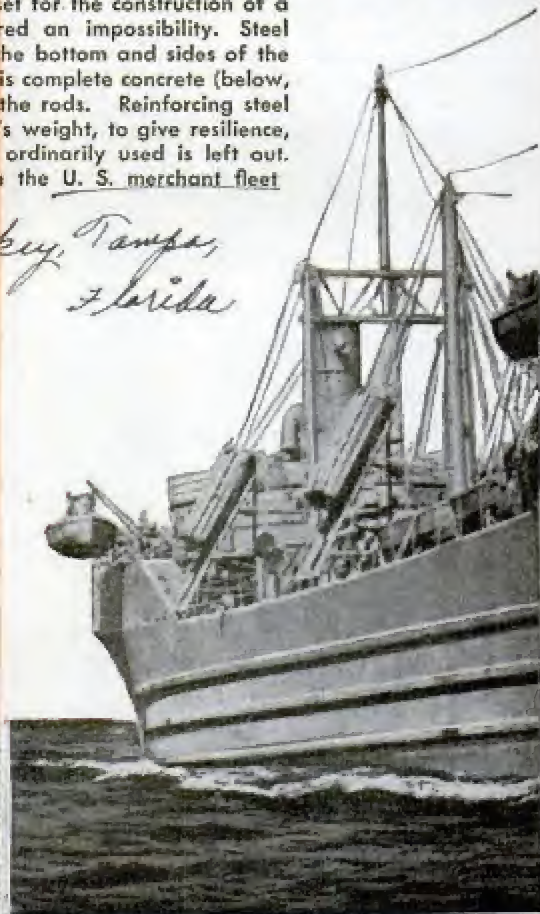
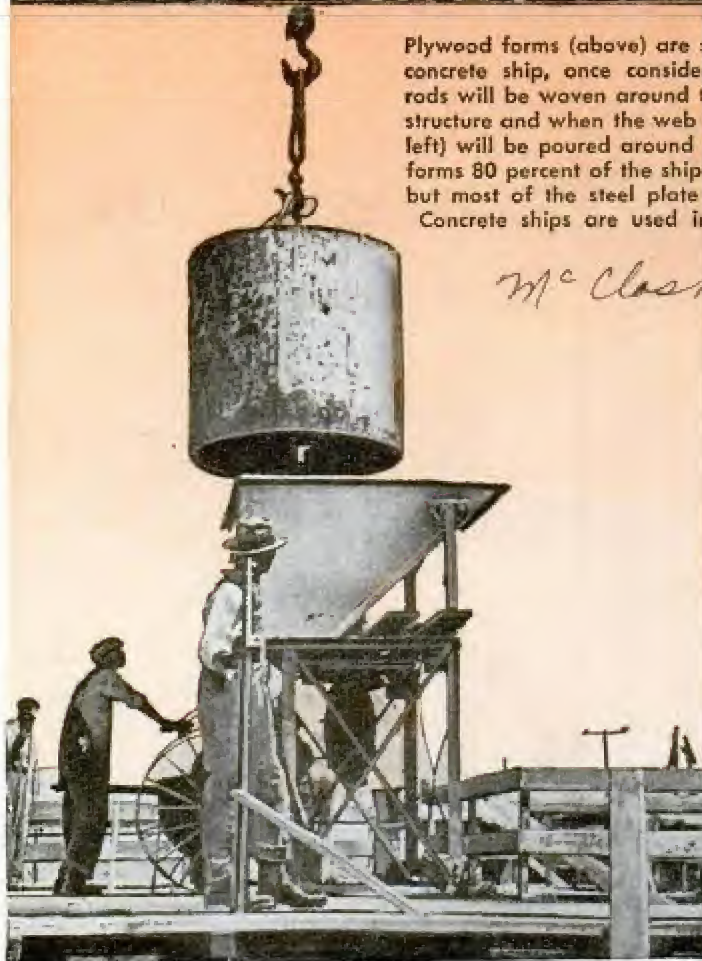
0215

CONCRETE AFLOAT



Plywood forms (above) are set for the construction of a concrete ship, once considered an impossibility. Steel rods will be woven around the bottom and sides of the structure and when the web is complete concrete (below, left) will be poured around the rods. Reinforcing steel forms 80 percent of the ship's weight, to give resilience, but most of the steel plate ordinarily used is left out. Concrete ships are used in the U. S. merchant fleet.

Mc Cluskey, Tampa,
Florida

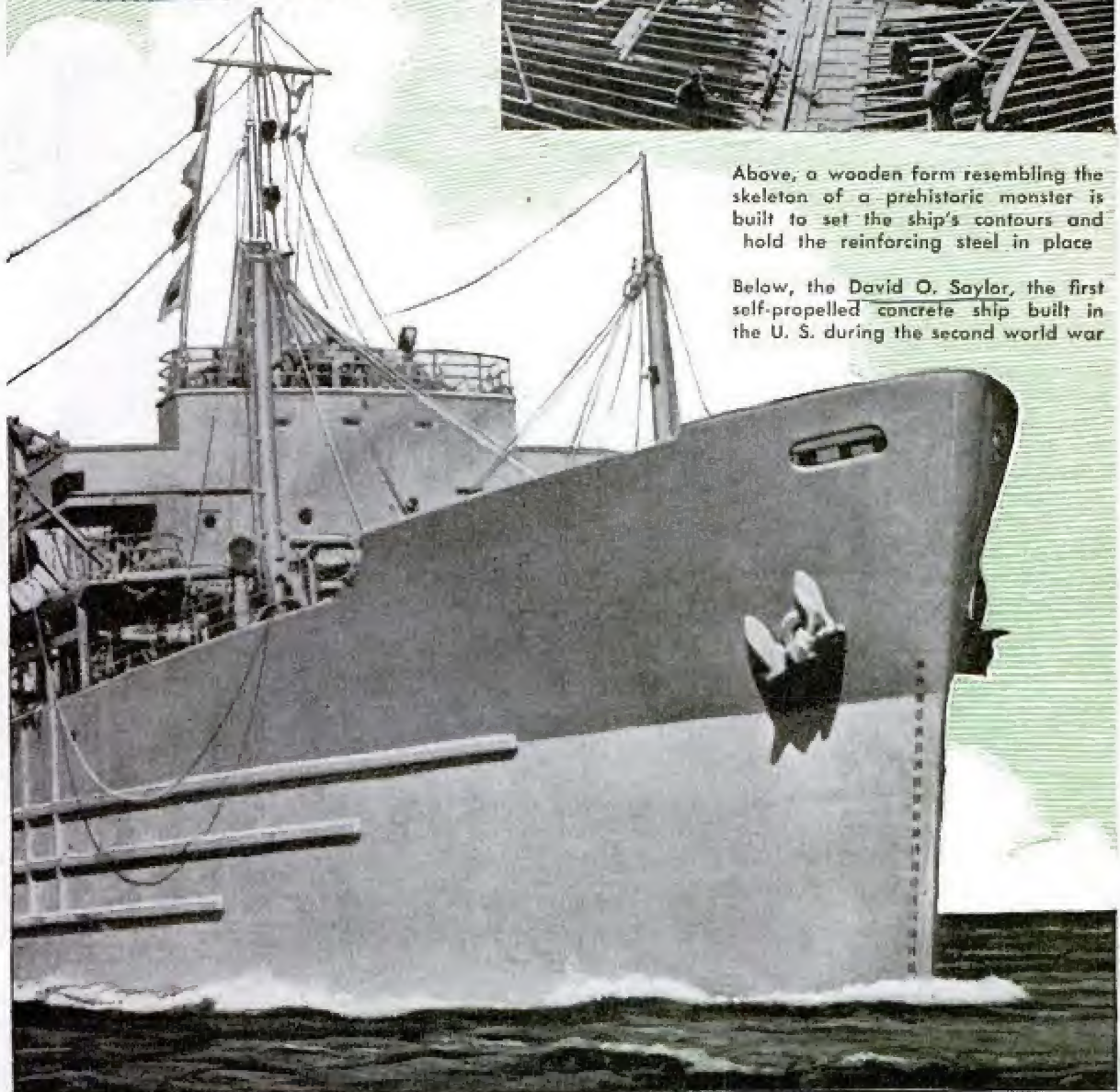




Above, a huge basin is excavated where the bottoms of concrete ships will be laid. There are three such basins in McCloskey & Co.'s shipyards at Tampa, Fla. Length of the ships is 366 feet



Above, a wooden form resembling the skeleton of a prehistoric monster is built to set the ship's contours and hold the reinforcing steel in place



Below, the David O. Saylor, the first self-propelled concrete ship built in the U. S. during the second world war

*M. F. J. Stame, Am. 2415 Navy Bldg.
Navy Dept., Washington 25, D.C.*

0432

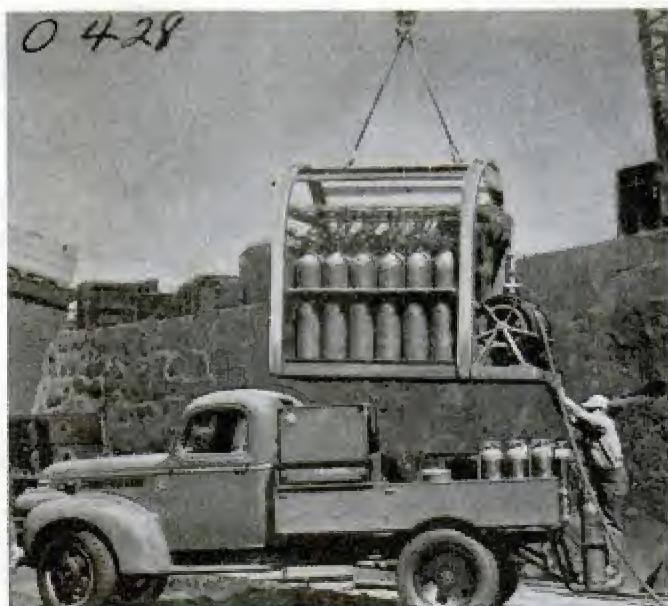
Makeshift Sand-Blaster Blows Coral Tornado



Navy Seabees on Espiritu Santo saved valuable time by improvising a sand-blasting machine from scrap and salvaged parts for cleaning old equipment. Unable to obtain the silica sand ordinarily used for the purpose, they successfully employed coral sand, dried and screened through an ordinary window screen. The machine holds enough sand to operate 30 minutes. Cleaning a salvaged motor, which took 7 hours, requires only 20 minutes with the sand-blaster.

Crane Lifts Gas Cylinders To Fight Shipyard Fires

As protection against fire breaking out in the shipyards of the Electric Boat Company, Groton, Conn., where submarines are built, 1,200 pounds of carbon dioxide fitted onto a platform can be swung overhead by crane to any point, leaping hurdles that would obstruct a fire truck. The gas is bottled in 24 50-pound cylinders arranged in four banks of six manifold cylinders each, with hose reel and nozzle attached. Each bank can be used independently, if necessary. Released, the gas expands to 450 times its compressed volume, driving out the fire-feeding oxygen and snuffing out the flames in seconds.



0428

Men Ride Wings of P-47 To Guide It to Runway

Mechanics riding on the wings act as the "eyes" of P-47 pilots in France, where ships at more than one field must be maneuvered carefully from their parking places through groves of trees onto a narrow taxi strip. Because of the bubble canopy on Thunderbolts the pilots have no direct forward vision when the plane's nose is up.

There are 5,000 pounds of rubber in a B-29 Superfortress, of which nearly two tons go into the 30 bullet-sealing fuel tanks.



0410

50-Seat Sky Liner Ready to Fly World Routes



Consolidated-Vultee Corporation introduced recently its postwar transport plane, the "Liberator Liner," designed to carry 50 passengers at a cruising speed of 240 miles per hour. Powered by four Pratt &

Whitney engines, the craft has a long nose, boatlike fuselage and stubby wing. Although it has a single tail fin, the ship has many parts which are identical with those of the famous B-24 Liberator bomber.

0311

Panel Links Newsmen Abroad With Radio Control Desk

A special panel for checking accurately on the quality of broadcasts originating

overseas and for keeping in touch with branch stations in other countries is used



in the CBS world news headquarters in New York City. The panel includes three rows of lights, marked "good," "fair" and "poor," by which the engineers signal the quality of broadcasts to the executives; a row of buttons marked with such outlying points as Anzio, London, Algiers, etc., for signaling the announcers and production men to go ahead. By pushing other buttons, Paul White, CBS director of news broadcasts, can hear overseas signals himself and can talk with correspondents.

*Columbia Broadcasting System
485 Madison Ave.*

0402

Air Force Seeks "Buck Rogers" Ideas for Long Range Experiments

Working on radical, apparently impractical ideas is the sole function of the "little group of dreamers" who comprise the engineering division of Air Force Materiel Command, according to Brig. Gen. Franklin O. Carroll, chief of the division. The general said he has given his group of young scientists and engineers orders never to have a practical idea, but to look ahead and concentrate on projects which cannot be realized for years. He pointed out that many features of aircraft which

are standard today once were considered "Buck Rogers" dreams of the future—for example, the internally braced wing, which eliminated exterior struts and wires; the supercharger, which enables planes to operate at high altitudes; the jet-propulsion plane and remote controlled guns. In their efforts to keep American airpower from three to five years in advance of the rest of the world, he said the engineers delve into every science from astronomy to chemistry and from physics to physiology.



Torpedo bomber over Jap-held Wake Island heads for "home" on completion of mission; radio-gunner will see plenty of action

Ordnance mates help radio-gunner install machine gun on his plane; turret guns protect bomber on dangerous homeward trip
Official U. S. Navy photos



THE PILOT had flown his Navy Dauntless dive bomber straight to the target, a Jap destroyer. His dive had been perfect. The bombs had hit the spot, and the quarry was listing badly. The offensive job was complete and now the plane was pointed toward "home," the deck of a U. S. aircraft carrier, hundreds of miles away.

Then came the Zeros. They came from behind, from above, from various angles that made it impossible for the pilot, with his fixed guns in the wings which fire only straight ahead, to defend his plane. It was up to the man in the rear turret—a man who spends 99 percent of his time in the air taking care of the routine duties of a flying radioman, and only one percent shooting at the enemy.

But the radioman was a gunner, too—an aerial radio-gunner, to be exact. A good deal more than one percent of his training had been spent in shooting instruction, and he knew all about deflection firing, the art of judging the range, angle of flight and speed of opposing planes so he could aim his guns at just the distance and just the angle ahead for top effectiveness.

That knowledge came in handy

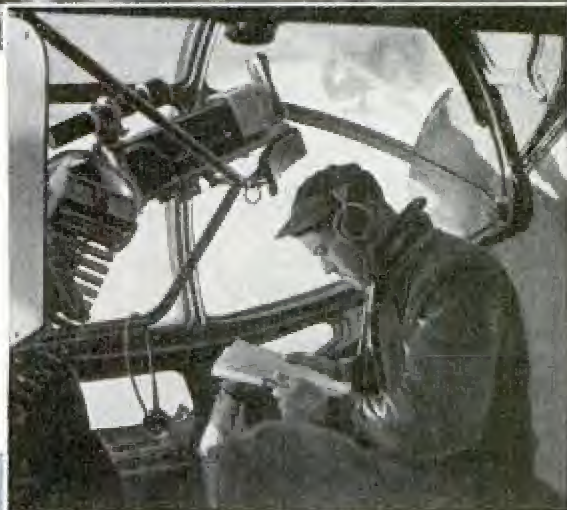
*Mr. C. N. Moore
1362 N. Dearborn St.
Chicago 10, Ill.*



Aerial gunner on carrier-borne fighter plane checks the swing of his gun before taking off to blast foe

as the plane sped home. The pilot did his part by flying a deceptive, zig-zag course. Attack after attack of Zeros failed. Some of them gave up the chase; others went down in flames. The radio-gunner had his part, also, in "bringing 'em back alive" from what might have been a disastrous mission.

Incidents like that one are becoming more and more frequent in the war against



Delayed by weather, gunner reads in blister turret. Left, radioman ready to fire



the Japs as the Navy's aircrewmen, a large part of whom are aerial radio-gunners, at last are getting the recognition they deserve in the fighting done by every type of Navy plane except single-seat combat ships.

Pilots long have been the focal point in descriptions of air combat and in honors and achievements. And their importance is by no means minimized in giving their crewmen a full share of the credit in what is perhaps the greatest combat team in the air—the Navy pilot and his gunner, whether the latter be radioman, ordnanceman or mechanic "on the side."



Student in power-operated turret mount works with his instructor



Gunnery students firing from power-operated turrets on trucks. Below, ensign on grotesque-looking turret-trainer tests marksmanship



Navy records, in fact, are packed with information about the individual accomplishments of aerial gunners. Many of them have been decorated, like John Liska who holds the Air Medal, three commendations and two Presidential Unit Citations and has four Jap planes to his credit, two in the battle of the Coral Sea, and two more at Santa Cruz. Another crewman, Harry Ferrier, received the Distinguished Flying Cross, Air Medal and two Presidential Citations

after three years of action in which he participated in almost every major Pacific battle. Some of them have well over 2,000 hours of flying time; others are brand new on the job. All of them know what it is to meet the Japs, plane to plane.

So vital is the task of these air crewmen that the Navy is making a special effort to augment their ranks from volunteer inductees at "boot camp." Because the requirements, mental and physical, are rigid, no direct recruiting appeal can be made since no advance guarantee can be given that any man entering the Navy will be qualified.

Once selected to be an air-crewman, however, an in-

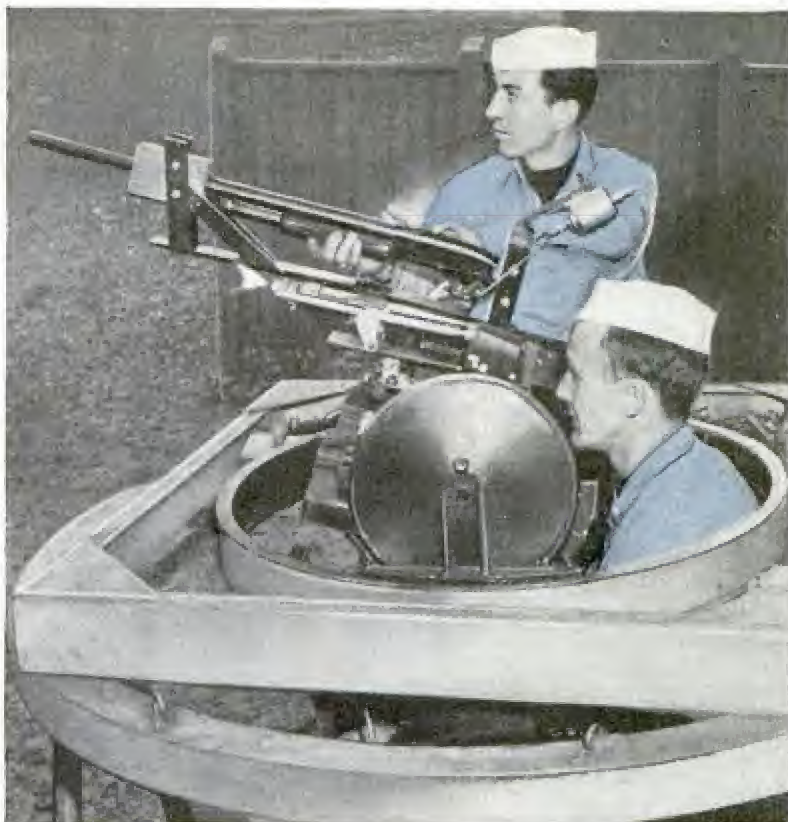
ductee is given one of the world's finest training courses, covering nearly nine months, which includes instruction expected to be of unusual value after the war in electronics, radio, automotive or aviation fields.

An aerial gunner, first of all, is a technician. If he is a machinist's mate, he is taught airplanes inside out and how to keep them flying—he must know the job well because he will fly in the same plane he must repair. If he is a radioman, he learns to operate radio devices. Or he may be an ordnanceman, specialist in guns. Then, all three ratings are trained to be expert gunners to defend planes during attack.

Special emphasis now is being placed on radio gunners since the Navy needs these men to help man the Dauntless, Hell-diver and Avenger—dive and torpedo bombers.

After eight weeks at boot camp, the aircrewman attends technical training school for five weeks, then the Naval Air Gunners' School for another five weeks. In the last 16 weeks of his instruction, he spends half in operational training and half in squadron formation flying. Upon completion of Naval Air Gunnery School the crewman receives the gunner's sleeve badge and may be provisionally rated third class at that time. When graduated from operational training he receives his wings, flight pay, leave, and is finally rated third class.

Formerly, wings were awarded only to men who had three months' experience with a combat unit. Now, the wings may be retained for a probationary period of 12 months as soon as the operational course is fin-



In "clay pigeon" test, student gunners practice with turret fixed with shotgun mount, learning to swing their bodies with the gun. Below, reloading twin .30-caliber guns on Navy Dauntless dive bomber on carrier





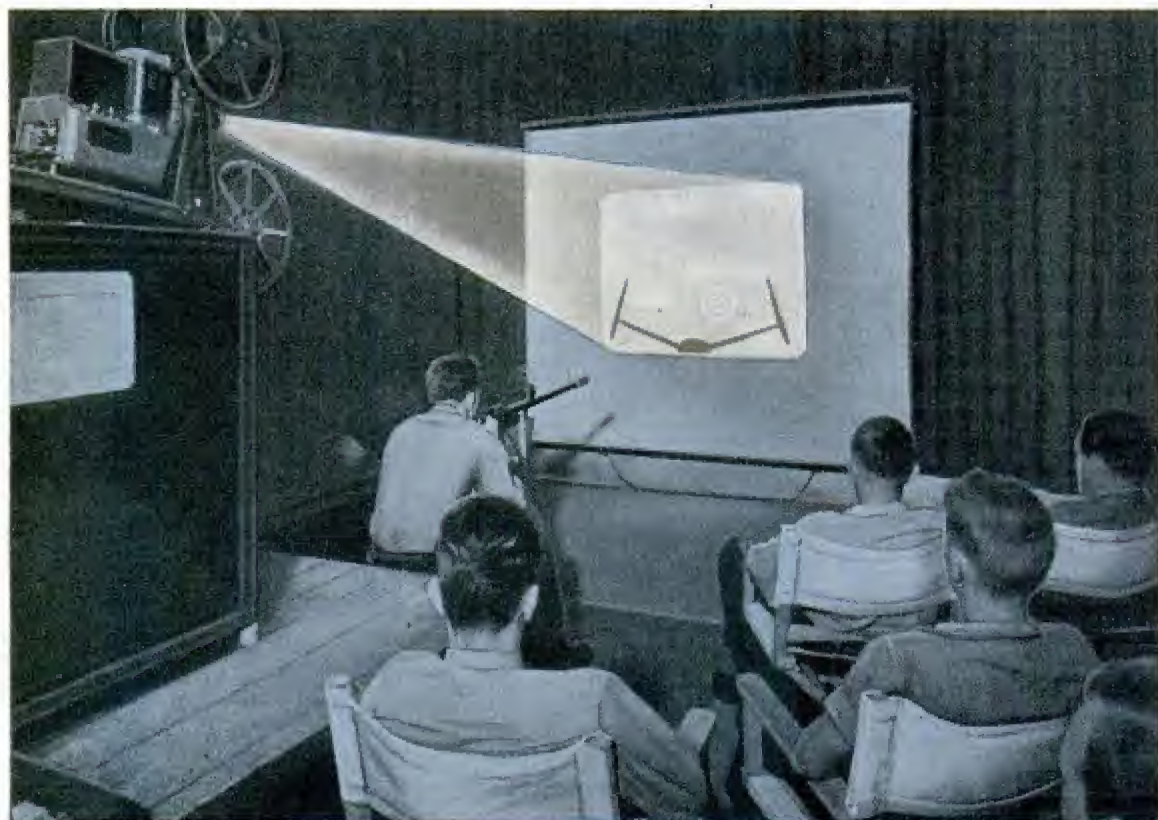
This flying photographer mans a machine gun as well as camera. Below, hits or misses are registered on screen showing plane

ished, and during that time may be awarded permanently.

Probably never before in the history of the Navy has the idea of teamwork between pilot and gunner been stressed as much as it is in training aerial gunners. During the final part of his training, the gunner teams up with the pilot with whom he will fly and when the training period is ended, he knows, almost instinctively, which way the pilot will turn and bank, and just how he will fly. The gunner, in fact, becomes what amounts to eyes in the back of the pilot's head, so closely do the two work together.

Having remarkable value in combat and in other critical periods when the plane is in the air, this teamwork likewise is reflected in many other tasks a pilot and his radio-gunner must perform in the countless emergencies arising in the battle for the Pacific.

It was the co-operation of pilot and gunner, for example, that helped write one of the most thrilling rescue chapters of the war in a recent attack on the Jap stronghold of Truk. The two, in a tiny Kingfisher catapult plane—a standing joke in the fleet be-



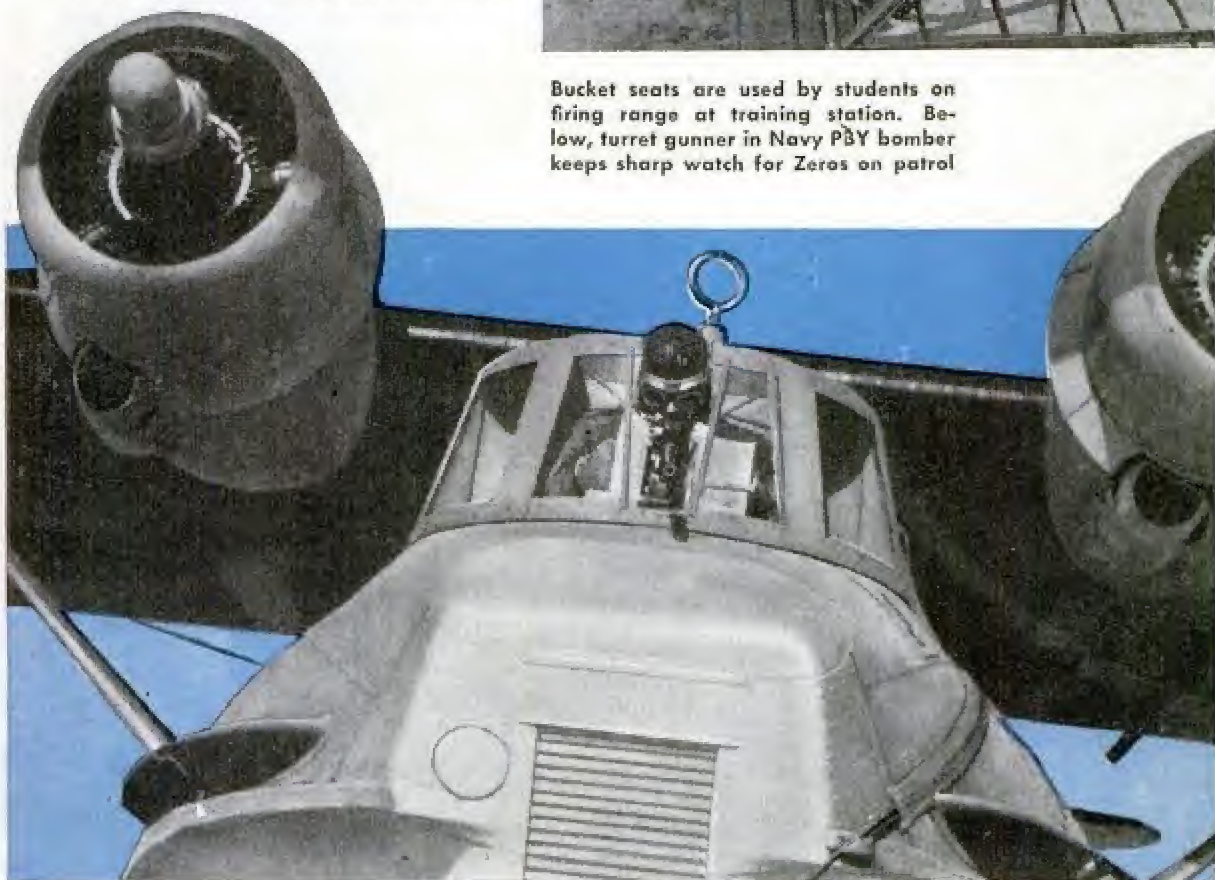
cause of its size—were sent to the rescue of the crews of two torpedo planes, a dive bomber and two fighter planes which had been shot down by Jap guns.

There were fourteen men in rubber rafts in the sea off the eastern reef of Truk atoll when the Kingfisher arrived. Since the plane can hold, at the most, three men, there was a single empty seat, the other two being occupied by the pilot and gunner. Taking on 14 extra passengers was out of the question, but the drift was toward the land and Jap guns, and something had to be done, quickly.

"Grab ahold, and hold on, boys!" called the pilot, while the radio-man leaned over to give assistance in making the rafts fast to the pontoons of the plane. The plane went forward, slowly—on the water, not over the water. For nearly three hours, the Kingfisher plodded ahead, with the radio-man half in and half out of his seat, helping his comrades. Finally, a rescue ship was sighted, and when it reached the plane, airmen were on the wings, the fuselage and the pontoons. All



Bucket seats are used by students on firing range at training station. Below, turret gunner in Navy PBY bomber keeps sharp watch for Zeros on patrol





Wave gives instructions to student in turret at Naval Air Gunners School, Hollywood, Fla.

hands were safe, though one pontoon had sprung a leak and some of the rubber rafts had been lost. Here again, the radio-gunner had helped "bring 'em back alive."

Had it not been for the teamwork of the pilot, Lt. John Burns of Wynnewood, Pa., and the radio-gunner, Aubrey James Gill, of San Francisco, the rescue could not have been completed with success, according to eyewitness reports of the heroism of both during the last lap of the exploit.

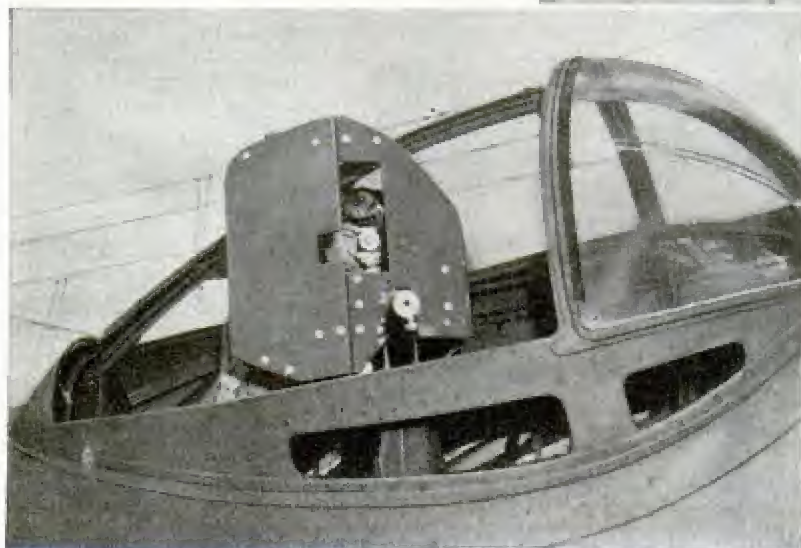
In the gunnery phase of the training period, one of the first things the men are told is that bringing down Jap planes is a whole lot like shooting ducks—"You can't aim where they used to be and get results—you must

learn to aim where the target will be by the time the bullet gets there." The Navy has its own special device for doing just that. It is called a ring sight.

The theory of duck shooting and the theory of aerial gun sighting are combined at the Naval Gunners' School. Trainees do their first shooting with shotguns at clay pigeons. At the start, there is trap-



Navy gunner (above) in waist "blister" of Catalina patrol bomber checks the sights of his .50-caliber machine gun. At left, heavy armor plate is protection for gunner as he squints through telescopic sight of machine gun mounted in the blister turret of PBV patrol bomber



shooting at "birds" flying away from the shooter in the same direction. Next is deflection shooting with a ring-sight equipped shotgun on a skeet range. Trainees are taught to shoot with both eyes open as F.B.I. experts do, and to keep the "bead" and "peep" always lined up while swinging with a fast moving target.

The next step is learning to shoot with a shotgun in a machine gun pivot mount, like waist gunners in Flying Fortresses. The shotgun has spade grips and a ring sight, and the men learn to swing their bodies with the gun when the clay pigeons are shot at difficult angles.

Before long, the trainee moves to a shotgun in a machine-gun mounting on a bucket seat, just like the seats in combat planes. Last of all, on the shotgun range, he climbs into a plane turret and learns how to manipulate the guns so they blast the "target" almost before it leaves a 40-foot tower.

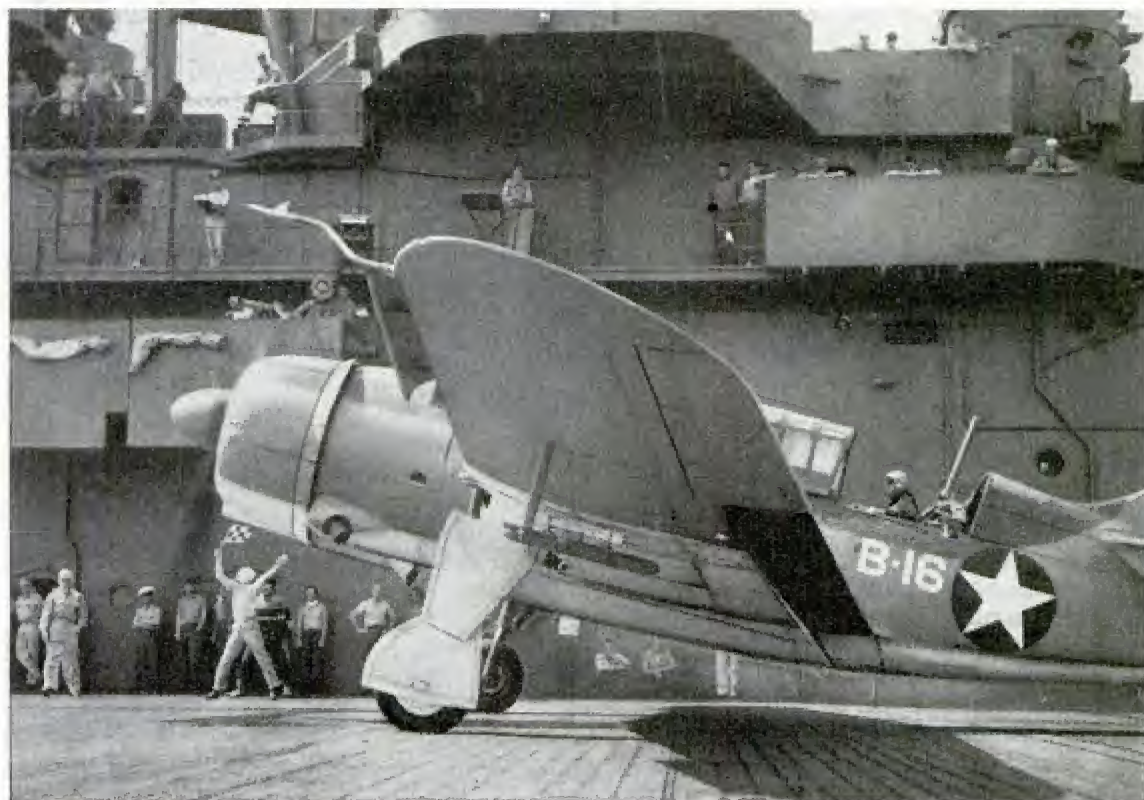
When the trainee graduates to real machine guns, he is at the beginning of a



Jap flag by the rear-seat gun position is for a Zero shot down over Truk

course that takes him clear through the alphabet of air gunnery and includes everything from tracer ammunition to making patterns with multi-gun mounts to create "hot" areas through which no enemy plane can survive. Actual combat films, many of them restricted, electric-eye machine guns, electrical apparatus, all are tied in together to make the course one of the most fascinating in the Navy.

Navy Helldiver is all set for takeoff from deck of a carrier; note exposed position of the radio-gunner



Army's "Weasel" Can Be Steered With Reins



Making "tracks" through deep snow, Weasels wear camouflage on boxlike tops. Left, car takes a steep slope

carrier is its simplified controls which permit the driver to steer with reins while he walks behind the car. Thus, if the Weasel should plunge into a snow-filled crevasse the driver would be saved. The vehicle has a demountable canvas top and is powered by a six-cylinder Studebaker engine and can be turned in a 12-foot radius.

Steering Weasel with reins protects driver if car drops into a crevasse

Deep snow, sand, mud or swamp land is no obstacle to the Army's new cargo and personnel carrier, the M-29. This low-slung, square-faced vehicle has been nicknamed the "Weasel" for its ability to strike swiftly and stealthily. The Weasel's broad tracks are rubber padded, and its light weight makes it ideal for reconnaissance, commando raids, or negotiating nearly-impassable terrain. Pressure on the ground exerted by the Weasel is only one-fourth that of a fully equipped infantryman. One feature of the



Studebaker factory in South Bend, Ind., for army

Magnetic Detector Locates Aircraft For Germans

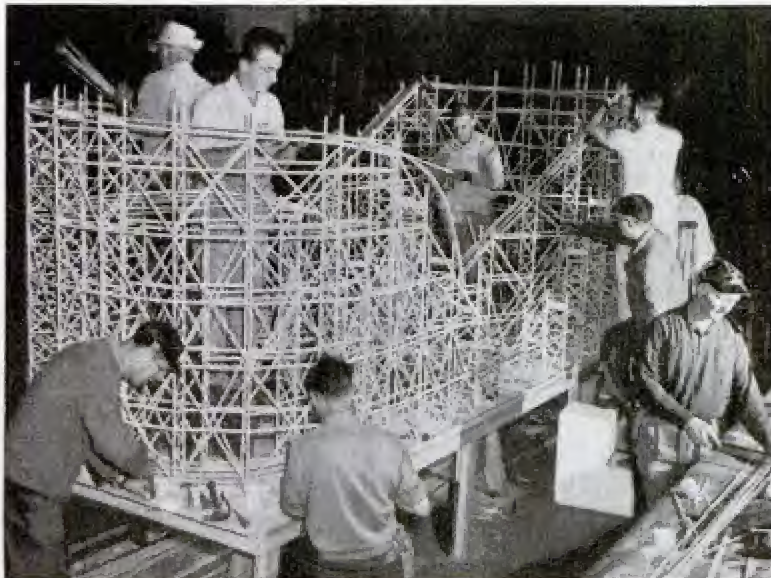
Aircraft spotting by a magnetic detector was one of Hitler's secret weapons, according to a German report coming through neutral channels. It is claimed that a huge mysterious-looking instrument throws out magnetic rays of great power which locate approaching planes long before they can be heard.

Photo of weird looking contraption used by Germans to detect approaching planes was received through neutral sources. The detector is said to send out magnetic ray



0316

Model of Coney Island's Roller Coaster Built in a Week for Movies



Coney Island's famous roller coaster was reproduced in a scale model in one week by the Universal Studios, Culver City, Calif., as a prop for a musical show. The replica, one of the largest scale models in the history of the movie industry, is complete with lights, turns, cars, and dizzy glides. The model was constructed with the assistance of Fred Knoth, who formerly built real roller coasters. In order to finish the model on schedule, Knoth and his crew of workmen labored 24 hours a day.

0322

Rubber Lining in Huge Steel Storage Tank Protects Purified Water

From five to seven tons of rubber line a 43,000-gallon steel storage tank to prevent corrosion from contaminating highly purified water used in the manufacture of high explosives, nitroglycerine and rocket powder. The lining consists of long strips of rubber nearly a quarter of an inch thick.

They are bonded to the inside of the tank with rubber cement, the seams being stitched by a machine to insure perfect bonding. The Army, Navy and Marine Corps and some industrial companies are using rubber linings in concrete storage tanks for holding high-octane gasoline.

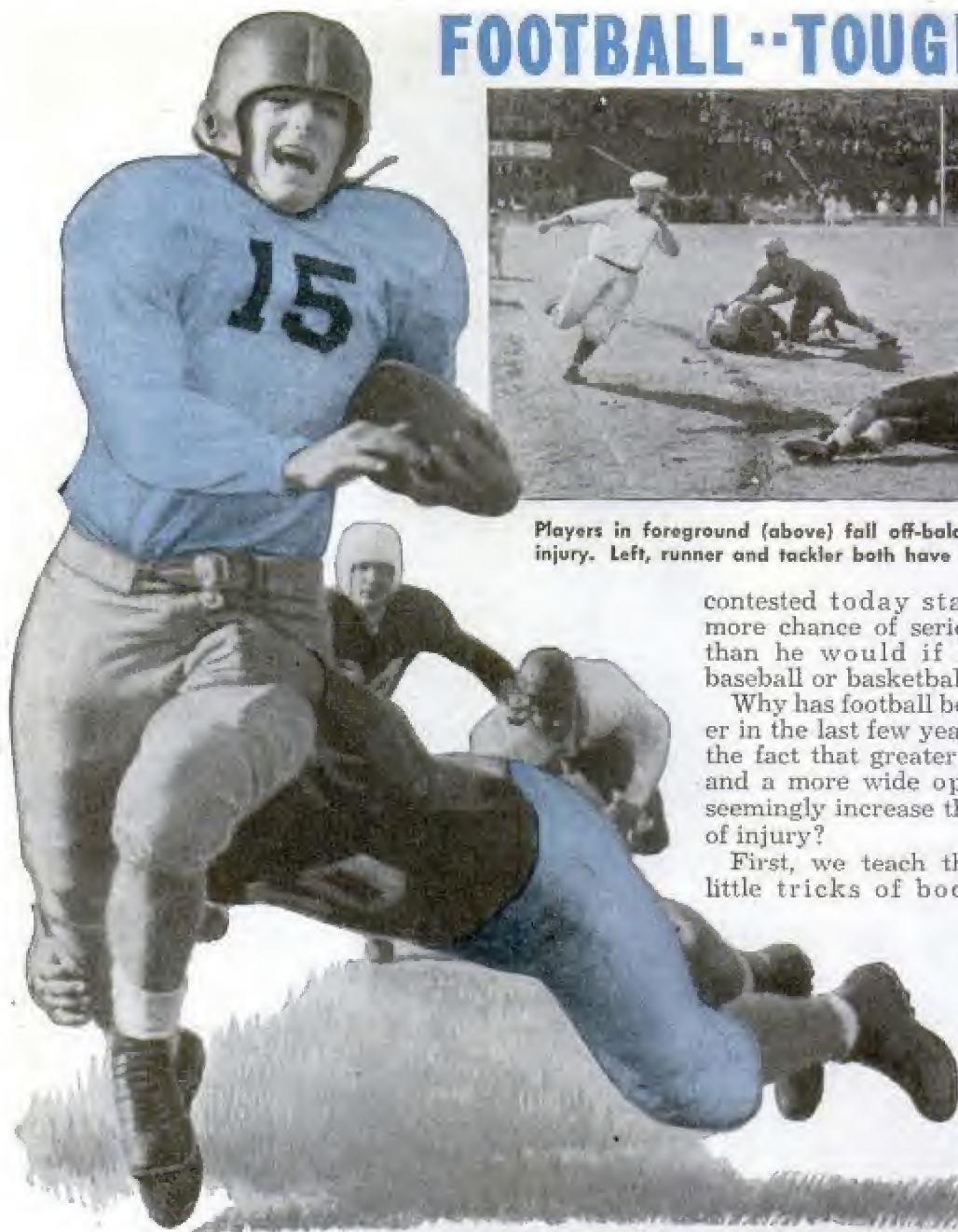
OCTOBER, 1944

*H. S. Rubber Co.
1230 - Sixth Ave.
N. Y. 20, N. Y.*

27

0408

FOOTBALL--TOUGHER



Players in foreground (above) fall off-balance, inviting injury. Left, runner and tackler both have body control.

contested today stands little more chance of serious injury than he would if he played baseball or basketball.

Why has football become safer in the last few years, despite the fact that greater deception and a more wide open game seemingly increase the chances of injury?

First, we teach the players little tricks of body control

By Lou Little

Football Coach, Columbia University

NOT so long ago the end of every football season brought with it a list of casualties among college players which frequently ran into the hundreds. Yet today, when college football is much faster and has sharper body contact than ever before, the game has become so safe that a serious injury is unusual and a death is news. In fact, a boy playing college football as hard as it is

Right, would-be tackler on ground lost control of his body and could easily get hurt



BUT SAFER



which probably are not noticeable to the spectators up in the stands but which reduce to a minimum the chances of getting hurt. In blocking, tackling, or simply falling down, there is a safe way and a dangerous way of doing each, and we drill every player in the all-important difference between the two. The difference is having control of the body upon making contact. When he has body control, a player executes the maneuver more effectively as well as more safely, even though it may not look so spectacular.

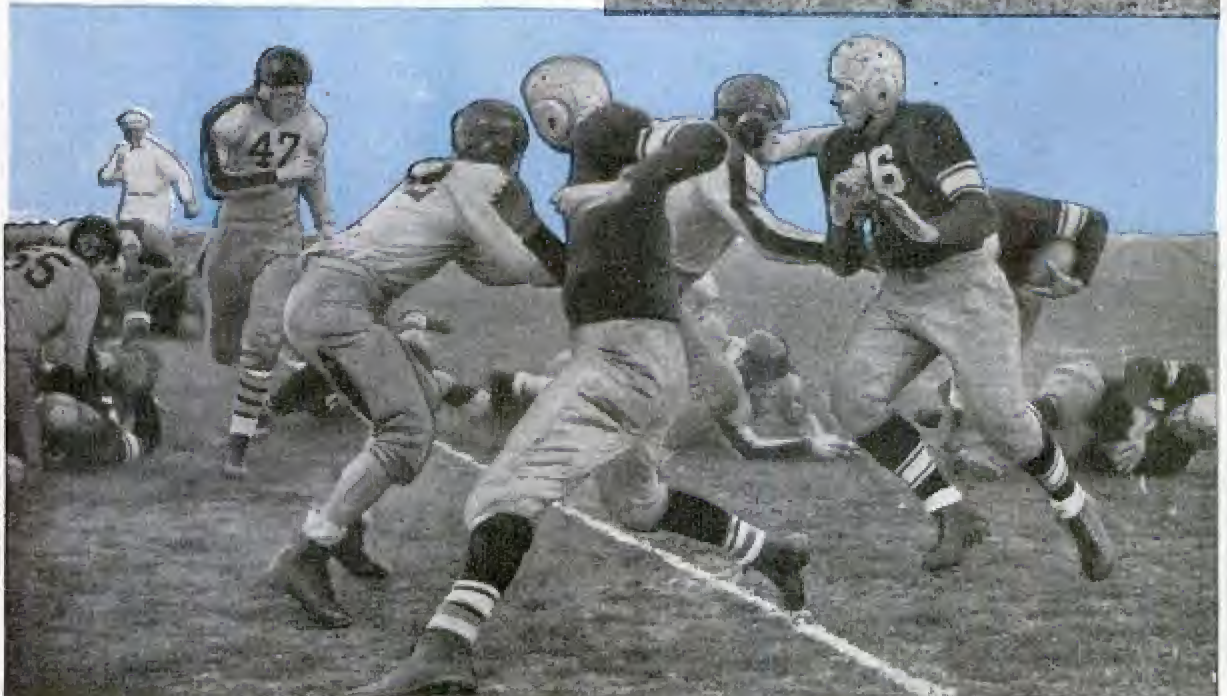
In the old days a player with a flair for dramatics would make a diving block or a flying tackle in an apparently heroic effort to get his man. That type of do-or-die stuff looks good in the newsreels but it is dangerous and usually ineffective. Nine times out of ten the player soaring through the air not only fails in his purpose but loses control of his body and lands on his shoulder, spraining it, or on his hip, tearing a muscle. Sometimes he lands on his head.

Currently players are taught to do things more sensibly. We tell a boy not to tackle or block until he is in such a position as to be able to complete the action, having full control of his body all the while. The player

Below, two players in foreground were off-balance and thus missed their assignments

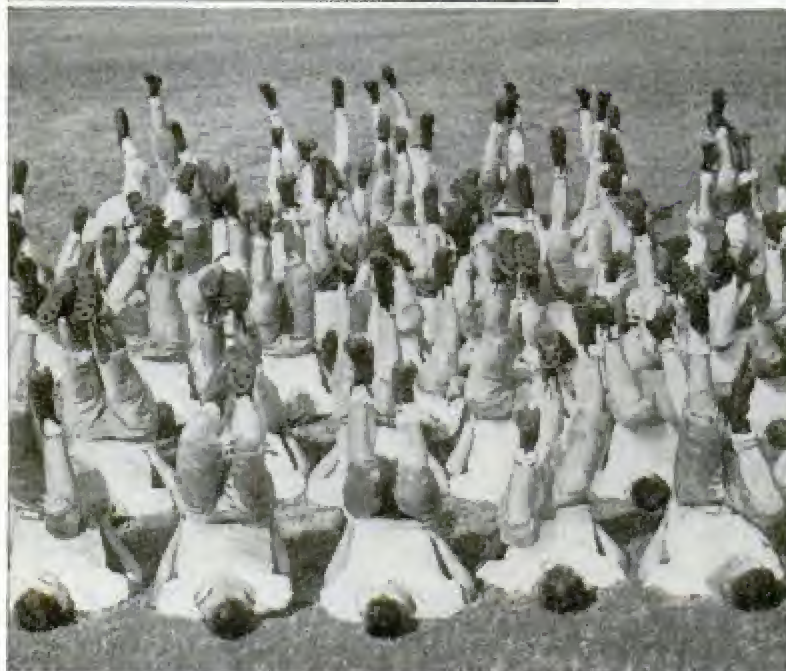


Above, safe way to block—head up with feet solid underneath, shoulders squared. Below, dangerous way to block





Football today is fast and wide open. Below, blocker stops tackler and falls straightened out



learns that when he makes a tackle he should be close to his target and driving ahead with his legs solidly under him, instead of reaching forward off balance. His head must always be up, and his shoulders squared. He looks at his target—nothing else! The same principles apply to blocking.

In practice sessions coaches pound these rules into their boys constantly. Great stress must be laid on them today because the more frequent and more imaginative use of the forward pass and other deceptive formations has opened the game up so much that there is harder, more violent contact between teams.

Nevertheless, there are fewer head and neck injuries than ever before. Why? Again—body control! A boy protects his neck and shoulders if he doesn't drop his head when he blocks or tackles. I tell the boys at Columbia to keep themselves as straight and rigid as a ramrod from the top of their heads to the base of their spines when making contact. Otherwise, they are likely to buckle up.

To my sorrow I gave a vivid—and painful—illustration of this point myself several years ago. I was working with an end and wingback, trying to teach them the proper way to handle the defensive tackle. After explaining the maneuvers in detail, I decided

←Limbering up before practice

the best way to show them was to do it myself. I put on a pair of shoulder pads and a head guard and started to scrimmage. Acting as the defensive tackle, I tried to outwit and out-charge the two players in a different way every time they flung themselves against me. After about 15 minutes of this, I got tired—and it happened. As I surged into them, I dropped my head and turned my shoulders a bit. Unfortunately they hit me with a shoulder block that had plenty of driving power behind it. In other words, they had perfect control of their bodies and I didn't. I felt something snap inside me and later discovered that I had fractured a transverse process of one of my cervical vertebrae. It meant two weeks in the hospital in a plaster cast, then for the rest of the season wearing a combination leather and steel brace which prevented me from turning my head and shoulder. It was an unforgettable lesson for the players but one which I hope I never have to repeat.

If he develops his neck and shoulders, a player has a much better chance of attaining perfect body control. For this reason I have every member of the squad bring a foot-square rubber mat with him to practice. On it before scrimmaging he is obliged to do "bridging" exercises, as if he were a wrestler. By twisting and turning every possible way he can put pressure on the neck and shoulders and strengthen them enormously.

Next time you go to a college game no-



Lineman wears "apron" which protects defensive players from injury during practice

tice the way a good player falls: he will always fall forward. His head will be up, his shoulders straight and his legs out behind him, so that there is no chance of another player piling on and injuring him.

To keep their faces from getting kicked I warn my players not to turn their heads away from impact. As long as they are driving on through their tackle, they won't

Continued to page 152

Safe and dangerous ways of tackling. Flying tackle is considered foolhardy as well as inefficient
Posed by Northwestern University players



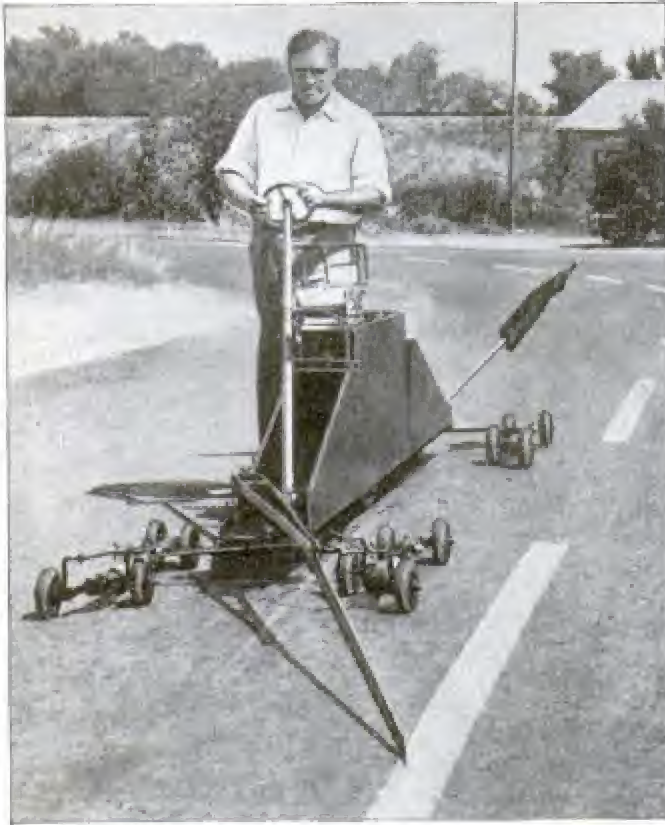
RIGHT



WRONG

0 346

"Bump-O-Graph" Road Scooter Measures Highway Roughness



Every bump or uneven stretch on a highway is measured and recorded with a 16-wheel machine that looks like a big scooter. Any inequality on the road surface that might interfere with the smooth rolling of an automobile is recorded by graphs. The machine, designed and tested by the California division of highways, has revealed highway surfaces are affected by seasonal changes and sudden variations of temperature or moisture. The "scooter" showed that a highway may be rougher at certain times of day than at others.

0 361

Magnetic Current Is Visible As It Sets Droplet Spinning

To prove the existence of nature's third force—the electric action of magnetic currents, Prof. Felix Ehrenhaft recently demonstrated what he called the first magnetic motor operating purely on magnetic current supplied by a permanent magnet. With an eye-dropper, the professor deposited a drop of ferric chloride, which carries natural electric charges, between the two poles of

a permanent Alnico magnet and adjusted the poles in such a way that both of them touched the droplet. Then he invited members of the American Physical Society to view the results through a microscope. The scientists saw something they had never seen before—the droplet was revolving between the two poles of the magnet without evidence of loss of energy, the direction of its motion being counter-clockwise from observation of the face of the south pole. Prof. Ehrenhaft explained the energy was supplied by the current flowing between the poles of the magnet, acting on the natural charges of the iron-chlorine ions.

0 237

"Soap Bubble" Plastic Forms Cockpit Cover

Blown like a soap bubble with "air-forming" technique, single sheets of transparent plastic are shaped into cockpit canopies for fighter planes. The Plexiglas "bubble," used on the Thunderbolt P-47, enables the pilot to see in all directions, and also reduces weight and wind resistance. The process by which the Plexiglas is actually blown to shape eliminates struts and frames, such as were used in earlier canopies.



Rehner & Sons
Bristol, Pa.
POPULAR MECHANICS

F. W. Sullivan
Engineer

'GLASS EYES' for G.I.'S

Wayne W. Kitzner 0356



Signal Corps photo
Yanks at an Arctic base take readings on big range finder, one of the most precise optical instruments in the world.
Below, seaman on lookout duty aboard ship of a task force
Navy photo

NATURE may have endowed Annie Oakley and Daniel Boone with telescopic vision and instinctive range finders, but the G. I. Joes and gobs of World War II make them look like pikers when it comes to finding the target. America's optical industry has furnished them with the "glass eyes" to do the job.

"You can't hit 'em where they ain't," is an old slogan aptly applied to fast-moving modern warfare on the ground, at sea, and in the skies. In order to "hit 'em where they are," our fighting men are equipped with thousands of precision instruments that include deadly accurate range and height finders, aircraft gunsights, tank sights, telescopes, telephoto lenses, bomb sights, periscopes, binoculars by the carload, and even ordinary spectacles which are worn by two million men in uniform. Mobile optical shops, equipped with cutters and drills, follow close behind the front lines.





Aerial machine gunner wears nonglare goggles—one of millions of pairs made by the American Optical Company

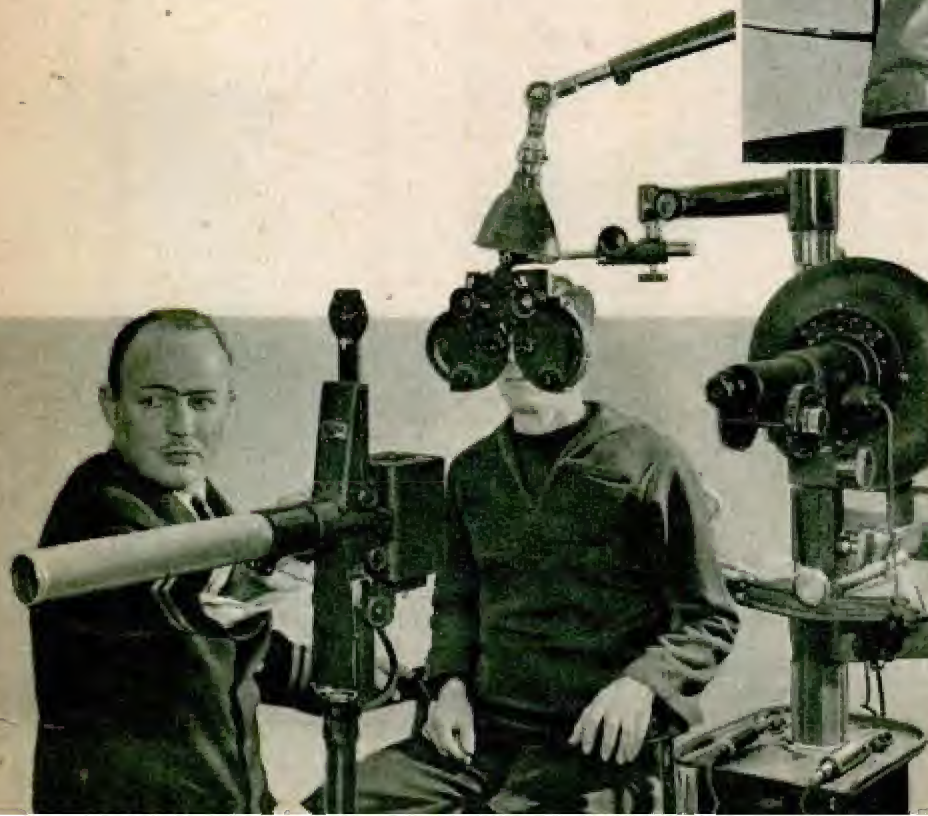
One company alone, the American Optical, produces more than 100 different products for the Army and Navy, ranging from sun glasses and safety goggles (2,500,000 pairs were shipped in one seven-month period) to field charting instruments: The Bausch & Lomb Optical Company, which pioneered the industry in this country in 1912, recently produced its 3,600,000th pound of optical glass since Pearl Harbor. Today, one of America's youngest industries has not only challenged but probably surpassed the century-old supremacy of Germany in the optical field.

The headlines that tell of German fortresses

smashed by accurate gunfire, or Jap batteries pounded to dust on Pacific islands only reveal part of the story. First, somebody had to figure the distance from gun to target. Range finders and aerial height finders, which are among the most precise instruments it is possible to produce,



Above, operating range finder on escort carrier. Left, eye-examining instrument used by Navy



help provide this information.

The largest type of range finder used on battleships almost fills a freight car, and when installed protrudes from either side of the ship's gun turret. These range finders may have more than 100 lenses and prisms

ground to tolerances measured in millionths of an inch. Deviation of one-half second of arc, according to Bausch and Lomb technicians, would make a difference of only an inch on a target six and a half miles away. That is why the first shell to be fired is often "on target."

Two types of modern range finders are the coincidence and stereoscopic. The former type brings two partial images of the target, whether an enemy pillbox or a smudge of smoke on the horizon at sea, into coincidence to determine the range. The common form of range finder consists of a metal tube within which is a bar and frame for the suspension of the optical system. At the end of the tube are windows behind which are reflecting prisms which receive light from the target. This light is directed along the axis of the instrument on which are arranged telescopic objectives, deflecting prisms, and the eyepiece assembly.

These range finders are so sensitive that it is possible to use them at night against a target that is only a pinpoint of light. In cases like this, an "astigmatiser" is used to make the point of light appear as two vertical streaks which can be brought into coincidence more accurately than a couple of split pinpoints.

The stereoscopic type of range finder



Navy photo

With eyes glued to periscope, a sub commander gives estimate of "enemy" ship's speed at training center

brings the complete image of the target into the same plane with a range mark.

This range mark consists of a piece of glass with markings to divide the field of view into equal squares which appear superimposed on the target.

Aerial height finders for antiaircraft fire control are stereoscopic instruments. During World War I, the altitude for antiaircraft fire was determined by the two-station altimeter. The modern self-contained instrument not only determines the altitude of the target but its range. This is believed to be the most complicated type of optical instrument known, and it can be used to gauge the distance of an approaching tank as well as a plane.

Another optical product of major importance on the battlefield is the telephoto lens used in aerial cameras. This photographic Big Bertha covers a nine-inch square of film, and the camera on which it is used takes pictures of amazing accuracy from 30,000 to 40,000 feet.

Another type of camera, widely used

Gunner of field artillery battalion in Italy adjusting aim in panoramic sight. The result: direct hit





After optical instruments help find target, squeeze of triggers sends forth stream of bullets from a PT

for mapping and reconnaissance, is the Bausch & Lomb metrogon. Its wide-angle lens is so free from distortion that equal areas from any part of the negative represent equal areas on the ground. Thus, a plane can accurately and safely photograph a target which is horizontally three to five miles away. Two of the metrogon's deep-curved lenses are paper-thin at the center and two are paper-thin at the edge.

Precision lenses have made it possible for the Army and Navy to make thousands of contour maps in a hurry. An intricate system, known as Multiplex, converts overlapping

aerial photographs into accurate maps.

Another lens, which is at the opposite extreme from the giant metrogon or telephoto, is the 16 mm. movie camera lens used by aerial gunners. When the gunner presses the trigger, the camera takes pictures of each burst.

One camera, built by Eastman Kodak,



Left, aerial camera is precision-built instrument which takes 220 exposures on one roll of film. Below, sighting into a glaring sun



photographs the stars around the zenith of the sky. This makes it possible for navigators to calculate their exact position at the time of exposure.

Optical instruments have been a boon in training programs. They provide our Army and Navy gunners with synthetic targets under conditions simulating the real thing. An aircraft training gunsight, developed by the American Optical Company and installed in the Special Devices Section of the Navy Bureau of Aeronautics, makes it possible to go through all the motions of an air battle without leaving the ground.

The number of optical instruments used on a modern battleship, such as the South Dakota, mounts into the hundreds. Without these instruments to supply vital information during navigation and attack, the ship which attained fame as the Battleship X would have been powerless. They include range and height finders, periscopes for the turrets and towers so that the men inside will be able to obtain a clear view of any action while protected by steel armor, alidades (cross-hair telescopes) mounted above the compass and used to keep the ships in line or in proper formation during attack, telescopic gunsights, binoculars, and even sun glasses.

Aside from helping G. I. Joe find the target, prisms and lenses are guarding his health and improving the weapons with which he fights.

Thousands of microscopes in Army and Navy medical laboratories are helping find new ways to safeguard health. In war plants, stereoscopic microscopes are used to ex-

Continued to page 154



Courtesy American Optical Company

Lookout using Polaroid goggles which have control button to admit or exclude light as desired. Below, gun director (foreground) 'scope in rear Signal Corps photo



0-401



Canopy Over Lift Truck Driver Catches Falling Crates

Drivers of small gasoline lift trucks who used to sprout bumps on their heads as souvenirs of falling crates don't have that hazard any more at the Douglas Aircraft plant in Long Beach, Calif. Company engineers rigged up safety canopies over the trucks and now drivers can load and unload their cargoes without dodging.

Shadow Compass in Flying Fort Gives Craft's True Heading 0395

To check variations on the plane's other compasses, a shadow compass has been installed in the astrodome of Flying For-

resses. Working on the same principle as a sun dial, a shadow pin mounted in the center of the compass throws a shadow which is interpreted to give the plane's true heading.

0-396

Automatically Fed Ack-Ack Gun Is Allied Secret Weapon

Less publicized than Hitler's robot bombs but highly destructive to German aircraft, a giant 120 mm. antiaircraft gun was regarded as one of the United States' major



secret weapons when the invasion of France began. Most of the gun's new features, including the principle of automatic feeding, were unknown to the enemy.

0282

Quick-Acting Magnetic Brake Stops Motor in Six Turns

Force which can stop a one-eighth horsepower motor traveling at 16,000 revolutions per minute in less than six turns is contained in a magnetic brake developed by Chester I. Hall, General Electric engineer. According to Hall, the force is accomplished by a cork shoe and friction, although magnetism releases it, once the need for braking is removed. The motor is braked at all times, except when current is applied. The brake, which is expected to be used widely for equipment in the armed services, consists of 15 parts, compared to 51 parts in the model previously used for this purpose.



developed by: Boeing Aircraft Co.
Seattle 14, Wash.

POPULAR MECHANICS

Schenectady, N. Y.

0 375

Spanker Paddles Riflemen Who Pull Hard on Trigger

Automatic spanking by a complicated contraption is the humiliation suffered by soldiers who don't follow instructions in correct trigger squeezing at Fort Custer, Mich. If the soldier pulls the trigger hard instead of gently squeezing it, the trigger releases a skate wheel, tripping a hammer. This pulls another wheel on the spanking machine which drops a weight into a box, releasing a spring and causing the crude but effective paddle to make contact with the seat of the erring soldier's trousers.



"Balloon" Splint Grips Fracture

0 451

For use primarily in emergencies, a pneumatic splint, consisting of a flat, rubber-surfaced sack with hooks along its edges so that it can be laced like a boot around a broken leg, has been devised by a doctor in Flint, Mich. After the splint is laced on, air is pumped in, or it can be blown in by ordinary human lung pressure.

Dr. G. J. Curry, Hurley Hospital



"Skybus" for Feeder Lines To Carry 24 Passengers

0 376

Dubbed the "Skybus," a high-wing, twin-engine, all-metal monoplane with tricycle landing gear has been designed by Douglas Aircraft Company engineers as the ideal postwar plane for feeder lines. The ship will carry 24 passengers, who will get full downward vision because of the high-wing effect. Two wide, truck-bed-level doors, an adjustable bulkhead in the cabin, and large baggage racks will assure quick and easy loading and will make it possible for the craft to be used for both passenger and cargo work. Extremely maneuverable on the ground and in the air, the "Skybus" will be powered with two 700 horsepower engines.

Santa Monica, Calif.

Dehydrator That Fits Into Oven Conserves Food at Home

0 390

Making home food conservation simple and scientific, a compact dehydrator made of hardwood can be fitted into the majority of ovens, whether they use gas, oil, coal or electricity. The dehydrator, which has three drying trays, is used in a partially open oven at low heat. It is easy to assemble and complete instructions for preparing foods go with it.



OCTOBER, 1944

Hammacher Schlemmer
145 East 57th St.
N. Y. 22, N. Y.

39

EXPANDING HOME MOVED



Expanding portable homes moved by highway truck or freight car may answer the post-war need for millions of homes in a hurry. While being shipped, the houses are 8 feet wide but expand to 15 feet when the bedrooms are rolled out. Standard length is 26 feet. Front and back demountable porches (example above) are included. Heating equipment, cupboards, kitchen appliances and most of the furniture are built in to save space. The central room is divided into livingroom (shown at left), diningroom and kitchen sections. An expanding house, minus the doors and windows, is shown on a truck below

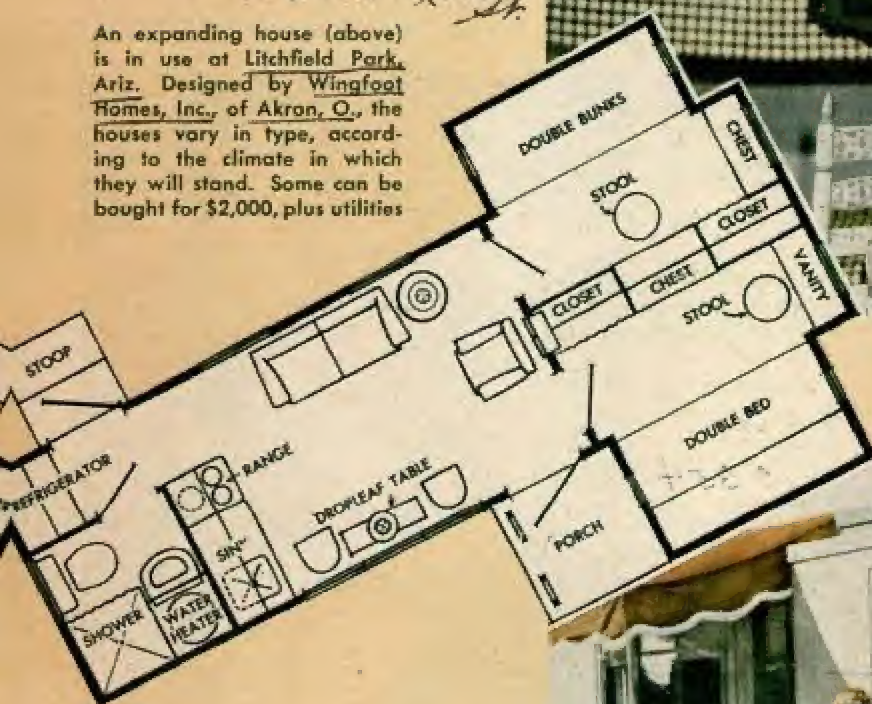


by TRUCK



1144 G. Market St.

An expanding house (above) is in use at Litchfield Park, Ariz. Designed by Wingfoot Homes, Inc., of Akron, O., the houses vary in type, according to the climate in which they will stand. Some can be bought for \$2,000, plus utilities



Above, portable house's floor plan. At right, bedroom wing of the house is collapsed to bring the house within the 8-foot limit for traveling on the highway. The wing, moving on a roller, is easy to collapse. The homes are popular as garden apartments and vacation shacks All Wingfoot Homes, Inc., photos

OCTOBER, 1944



Another view (above) of the large combination room, with the kitchen stove, sink and cupboard visible in the background. Scores of these homes already are sheltering war workers where housing is scarce



In the master bedroom (above) the double bunks provide sleeping space for a family of four



Hitch-Hiker on Parachute Rides Safely to Ground



When a paratrooper ^{L.S. N.Y.} on maneuvers at Camp McArthur, N. Y., found himself falling through space with a parachute which wouldn't open, he grabbed onto the billowing 'chute of a fellow paratrooper without waiting for an invitation. They descended together safely. Before they landed, the embarrassed jumper's emergency 'chute opened, but too late to be of assistance.

Color Film Processed at Home In Only Ninety Minutes

Amateur photographers can process their own color film at home in only 90 minutes, using the new color film developed by the AnSCO Corporation, Binghamton, N. Y. Until recently the film, which comes in 16 mm. movie film as well as sheet film, was made exclusively for the armed forces and war industries. The film reproduces color images through "subtractive color synthesis," which is based on the theory that almost all colors can be reproduced by re-establishing a proper

ratio of the blue, green and red rays reflected from the object photographed. The film is composed of three layers of emulsion, the top layer of silver halide crystals recording the blue light reflected by the object, the middle layer recording blue and green, and the bottom layer recording blue and red. A yellow filter layer between the first and second layers stops the blue rays from progressing further. Thus the green rays reflected from the object are recorded on the middle emulsion and the red rays on the lower without the blue interfering. Using the special color developer the photographer then brings out the positive color images in the three emulsions. Prints are made by the usual three-color separation method. Another advantage of the process is that after the first 15 minutes of the developing period the film may be stored or shipped, leaving completion of the process to some future time.

0 394

Idle Rivet Guns Put in Holsters To Reduce Accident Hazard

Canvas and leather holsters large enough to hold idle rivet guns are supplied to riveters at a General Motors aircraft plant. Each holster has a hook in its back so that it can be hung on any convenient pipe or rack. Besides saving much stooping, the holsters prevent the risk of rivet guns left lying on the floor, a former accident hazard.



POPULAR MECHANICS

*Eastern Aircraft Div.
Linden, N. J.*

Duke Felt
1234 N. Pershing St. O 373
Burbank Calif.
Rocket-Propelled Model
Has Wings Near Tail

While German rocket bombs soared into England, youthful model builders in the United States were matching their rocket planes in exhibitions. One rocket plane model at the Los Angeles Aero Modelers contest recently had its wings near the rear of its fuselage, next to a large tail fin. The horizontal stabilizer was in the front of the fuselage. The model builders launched their planes by lighting a rocket fuse.



O 342
Scene Is "Etched" on Leaf
By Scraping Surface

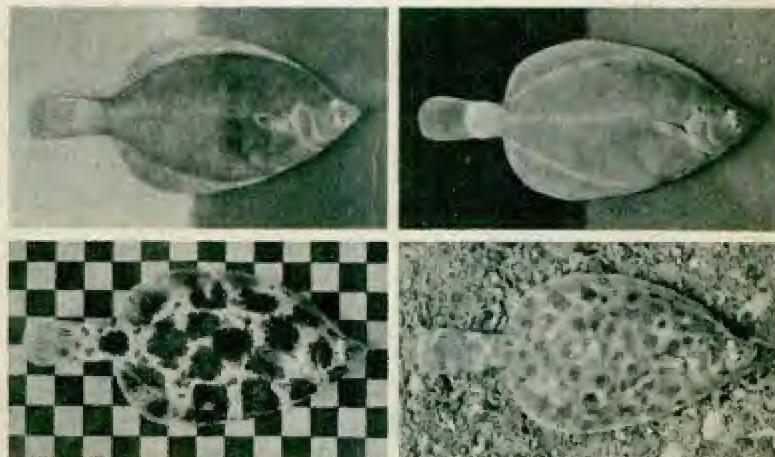
By means of a novel and elaborately painstaking technique, "etchings" are made on leaves by Brother Adrian Lewis, of Manhattan College, New York City, as a hobby. Using a simple, sharp-pointed instrument, he makes the "etching" or drawing by scraping away portions of a leaf's green surface in varying depths, depending on the shading desired. The art form was suggested by insects' habit of eating away the green matter of leaves. Since 1914 the brother has turned out hundreds of leaf "etchings," most of them dealing with a religious theme. Each takes from two to six hours to produce.



O 267
Fish Change Color Camouflage as Their Eyes React to the Seabottom

Quick-change artist of camouflage is the winter flounder whose eyes control its color. Impressions received through the eye and relayed through the fish's nervous system cause the flounder to take on the color of the seabottom on which the head lies. Eye control of color in the flounder and other fishes of its type was proved by placing the fish against a variety of natural and artificial backgrounds, according to Karl P. Schmidt, curator of the department of zoology at the Chicago Natural History Museum, formerly the Field Museum. If the fish is blind, no change in color takes place. Some fish also

change color due to nervous stimuli, such as fright, causing a secretion of the pituitary gland at the base of the brain. Both sets of color controls may be combined in the same fish.



OCTOBER, 1944

Mr. Orr Goodson, Chicago Natural History Museum
Roosevelt Rd. & Field Dr.
Chicago 5, Ill.

SECRETS *of* SUPER-SPEED



With "throat" bared, engine of new P-51 gets a final test. Note jet propulsion exhaust stacks on sides. Below, four-blade "prop" boosts speed



ORDINARY air, so familiar to us that we hardly ever think about it, is a temperamental mysterious substance to the men who design our high speed aircraft.

Airplanes couldn't fly if there was no air, and yet it is air that impedes aircraft from flying faster than they do. Air will do one thing under certain circumstances; it may behave quite differently if the circumstances are changed in the slightest degree.

On a hot day we stir air into a breeze to keep us cool, but one of the problems in aviation is to find a way to keep a pursuit pilot from becoming overheated by the cold breeze that is admitted to his cockpit for ventilation. The incoming air slows down in the cockpit and as a result becomes compressed. Compression causes heating. The rise in air temperature may amount to 30 degrees in the case of a pursuit plane of the 400-miles-per-hour class. This heat plus warmth from the engine often makes the cockpit uncomfortably warm even when the outside temperature is unpleasantly cold.

One might suppose that an airplane tends to be compressed or squeezed together at extremely high speed because of the pressure of the air through which

O 340

Thomas C. Stinson, Jr.
3872 Franklin Ave.
Los Angeles 27, Calif.

Convex rear-view mirror in P-51 cockpit (right) gives the pilot wide angle of vision. Below, cutaway drawing of North American Aviation's fighter reveals ingenuity of engineers. Note how the retractable tail wheel is housed inside tail. Front view (inset) shows why the P-51 has slight wind resistance



it moves. The truth is just the opposite. At high speed an airplane tends to burst. The skin tries to pull away from the main structure. Doors fly open if they are not securely fastened. The reason is that the plane's leading edges force some of the atmosphere away just as the bow of a moving boat

Pilot's control stick on Mustang P-51 fighter is attached directly to wing for maneuverability



Sealed-beam type of landing light on P-51 retracts and folds into wheel well when wheels are retracted

pushes water from the hull. An area of reduced pressure is produced around the airplane. At high speed the plane literally flies in a partial vacuum and it tends to expand. The structure must be built to resist this outward pull.

Air packs a hefty wallop when you move through it at high speed, as you can tell by putting your head out of the window of a fast automobile. But the push that your face receives at 70 or 80 miles per

hour is negligible compared to the force imposed on an airplane that flies in excess of 400 miles per hour, or that builds up to a speed of 600 miles per hour in a dive. Power alone is not enough to push an airplane against such tremendous headwinds. The structure must be cunningly streamlined to lower its resistance to the air.

An outstanding example of how aerodynamicists and engineers are building speed into the design of a plane is North American Aviation's P-51 Mustang fighter. This plane has an announced ceiling of 40,000 feet and a top speed of around 425 miles per hour. It is a large, heavy airplane and yet it offers no more resistance to the air than would a flat plate three and a half square feet in area. To the air, the P-51 is smaller than nine pages of this magazine laid side by side.

To achieve this startling effect the North American Aviation aerodynamic staff did more than simply design a clean and streamlined plane. In half a dozen different ways they tricked the atmosphere into helping boost the plane along instead of retarding its flight.

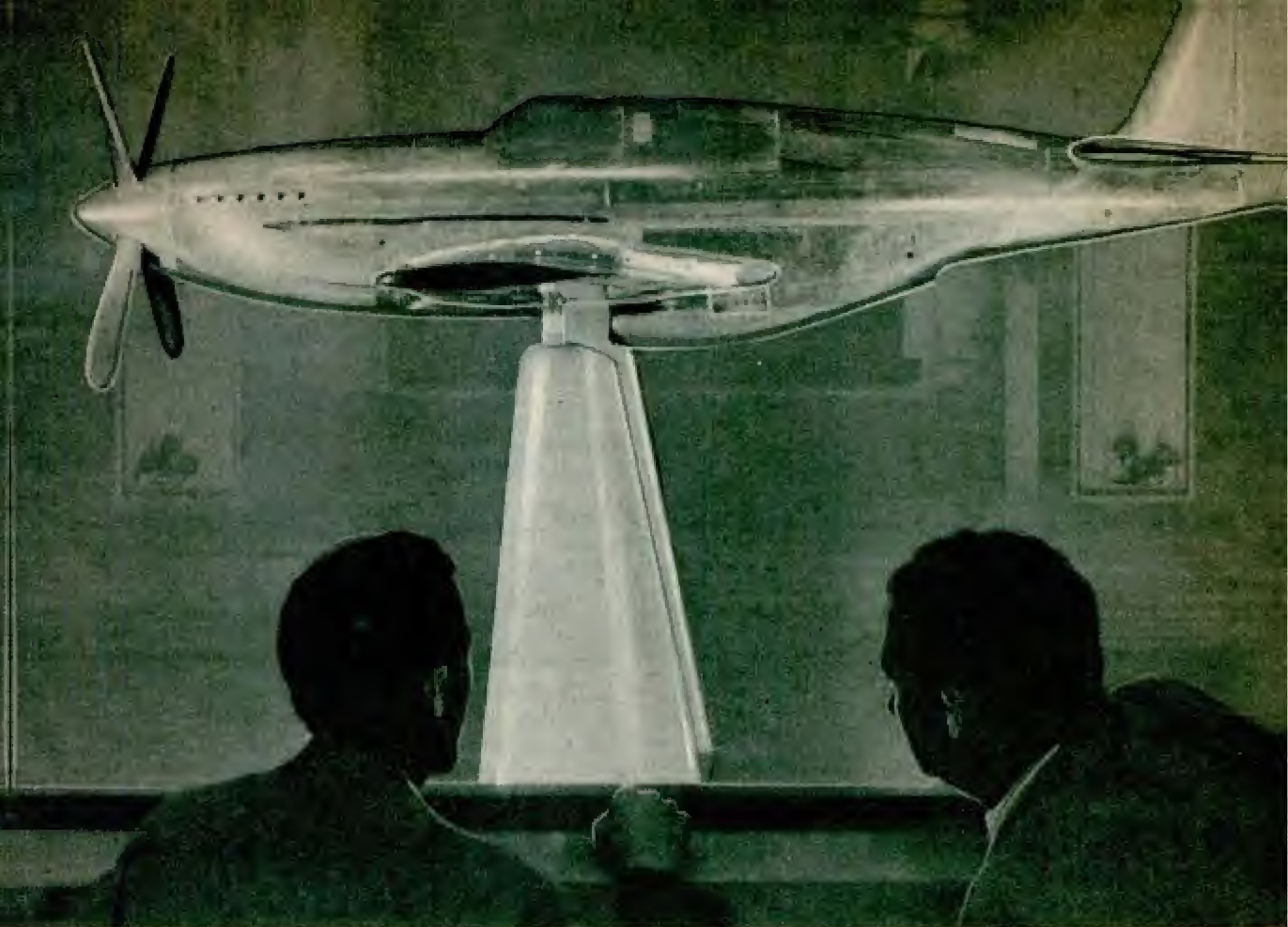
They designed the air intake duct that leads to the carburetor in such a way that the air rams itself in. This supercharging effect is so pronounced that at 30,000 feet the engine breathes air that is equal in density to the atmosphere a full mile below.

It is standard practice to obtain a slight amount of forward thrust from the discharge of engine exhaust gases. For the Mustang the engineers experimented with



Inspecting non-drag air intake scoop. It leads cold air to radiator and expels it without the loss of speed

Radiator unit of Mustang is slung beneath fuselage in a 10-foot streamlined tunnel that is open at either end



Wind tunnel test on P-51 model reveals air resistance equal to flat plate about three square feet in area

different designs of exhaust stacks until they found a shape that provides true jet propulsion. These stacks boost the total useful horsepower by some 200 h.p. and contribute 25 miles per hour to the plane's top speed.

The designers lost half of this increase in speed when they were asked to attach bomb racks under the plane's wing. Protruding only a few inches, these racks cost 15 miles per hour because of their interference with the flow of air.

If such bomb racks cost 15 miles per hour, what would the drop in speed amount to when you stick a radiator that has a cross section of 400 square inches out in the wind? Theoretically this radiator would cut the top speed of the plane by 100 miles per hour. Actually, in the case of the P-51, the loss is less than one mile per hour.

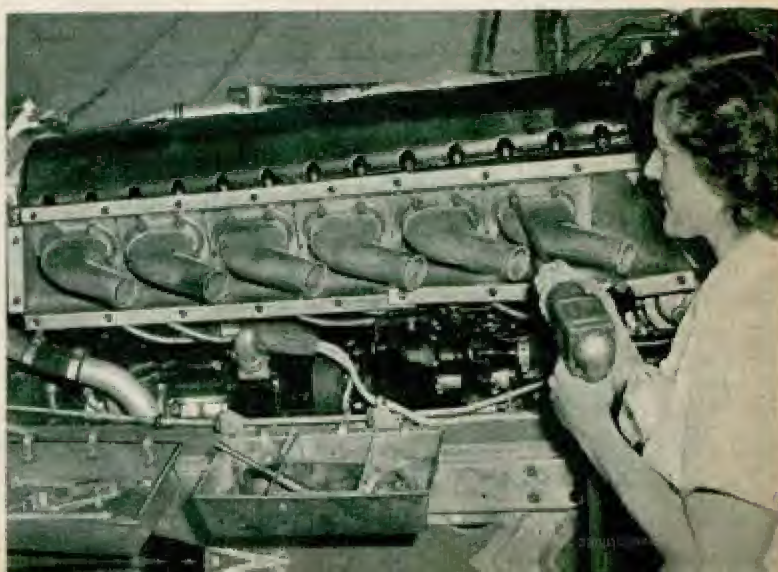
This radiator is needed for cooling the water and ethylene glycol solution used as the engine coolant. North American Aviation's thermodynamic staff worked on the radiator prob-

lem until they got something for nothing. They placed the radiator out in the air where it would set up a terrific drag, then they enclosed the radiator in a tunnel that is 10 feet long, as deep as 15 inches below the fuselage, and open at each end. This duct under the P-51 looks like a long scoop. Bulky as it is, the duct is the secret of how the radiator gets a free ride.

At the plane's top speed, the forward end of the duct scoops in air at about 300 miles per hour. The air slows down to about 50 miles per hour by the time it moves aft to

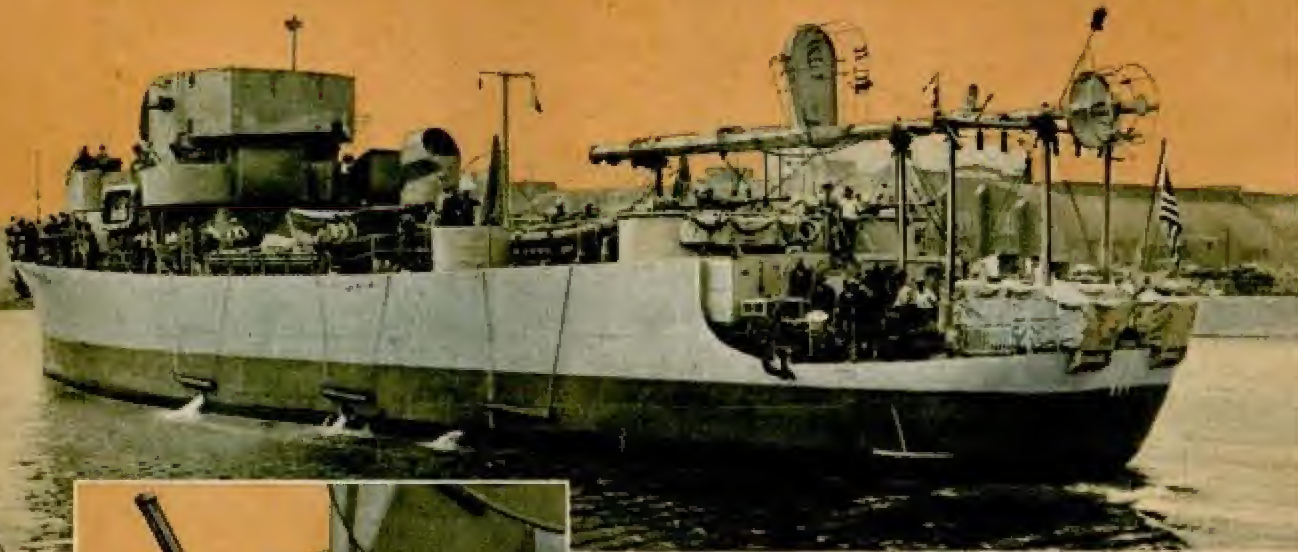
Continued to page 156

Attaching jet exhaust stacks to engine that add 30 m.p.h. to speed of Mustang



0 341

Sub-Chaser Is Convoy's Rescue Boat-Hospital



Sub-chasers, officially known as PCE-R (patrol craft escort, rescue) boats, have been converted into "floating hospitals" so that adequate medical attention will be available in convoys. Each ship contains bunks for 57 passengers and has a doctor, operating table, dispensary and X-ray machines in addition to other standard hospital equipment. Like other PCE boats, they are manned by seven officers and 100 men. PCE's are Diesel-powered, 180 feet long, and are equipped with big guns, several anti-aircraft rifles and depth charge tracks and throwers. They displace more than 800 tons and can be used to follow up landing craft in an invasion. Almost as self-contained as a battleship, a PCE is able to remain at sea for extended periods.

Mobile Factory Workshop Has Outlets for Power Tools

To save a mechanic trips back and forth to his workshop for more tools, a portable tool crib has been mounted on casters by the Hubert Creeper Company, Ashtabula, O. By taking his mobile workshop with him anywhere in a large plant, the mechanic can keep handy all the tools he needs to complete the job he is working on. A panel made of half-inch plywood can be made to lock over the front of the crib while not in use. Electric tools plug into outlets on the side of the cabinet and a 75-watt bulb is located in the top section. It required only 12 manhours to make the crib at a cost of \$7.50, exclusive of casters. By slightly altering the design, it can be adapted to the needs of electricians, plumbers, or carpenters.

48 *Hubert Creeper Co.*
Ashtabula, Ohio



Helicopter Is Ambulance and Courier at Front



Greater power, speed and range are characteristics of three helicopters built by the Sikorsky Company at the request of the Army and Navy. For example, the XR-5 model, in which the pilot sits in a Plexiglas compartment in the nose, has a speed in excess of 120 miles per hour, can operate efficiently more than a mile above the earth, can take off or land over a 50-foot obstacle at zero-forward speed, and can remain in the air for more than three hours. Its maximum load is more than 1,100 pounds, including pilot and observer, and its rotor is the largest ever used on a helicopter. It also has a tail rotor.

Because the R-5 may be converted into a hospital craft, provision has been made for carrying four litters, two on each side. Tasks for which the new helicopter models can be used are rescuing of personnel from



areas that are inaccessible to ground crews or other types of aircraft; liaison and messenger service within combat areas and behind the lines; and observation and fire control in forest areas.

0 261

Robot Glider Pilot Holds Course If Tow Plane Is Invisible

As a result of the installation of an automatic pilot, gliders can be set to follow the tow plane at a given altitude on a true course, even when the tow plane is hidden by bad weather. Formerly it was necessary for the pilot at the manual controls to see the tow plane in order to follow the course. The auto-pilot, which also pre-

vents the pilot from becoming overfatigued on long trips, has an instrument panel similar to that in an airplane. A small propeller, located in the outlet of an air-driven pump in the glider's nose, furnishes power for hydraulic and vacuum pumps, which operate the gyro units. The latter mechanisms, in turn, operate the controls.



The NEW AGE of STEEL

Above, molten steel from open hearth furnace is poured into ingot molds. Below, arc welder wears Voodoo mask to protect himself
Lincoln Electric Co.



BACK in the days when knights fought in suits of armor with heavy spears and shields on mail-clad horses, every man and his steed carried around 200 pounds of iron and steel—a healthy load.

Today the U. S. steel industry has become so huge it could produce enough to equip around 2,500,000 such knights per day, and take the job right in its stride.

Every half hour U. S. steel mills produce enough to build and completely equip one new destroyer, and every 24 hours the total is sufficient for two



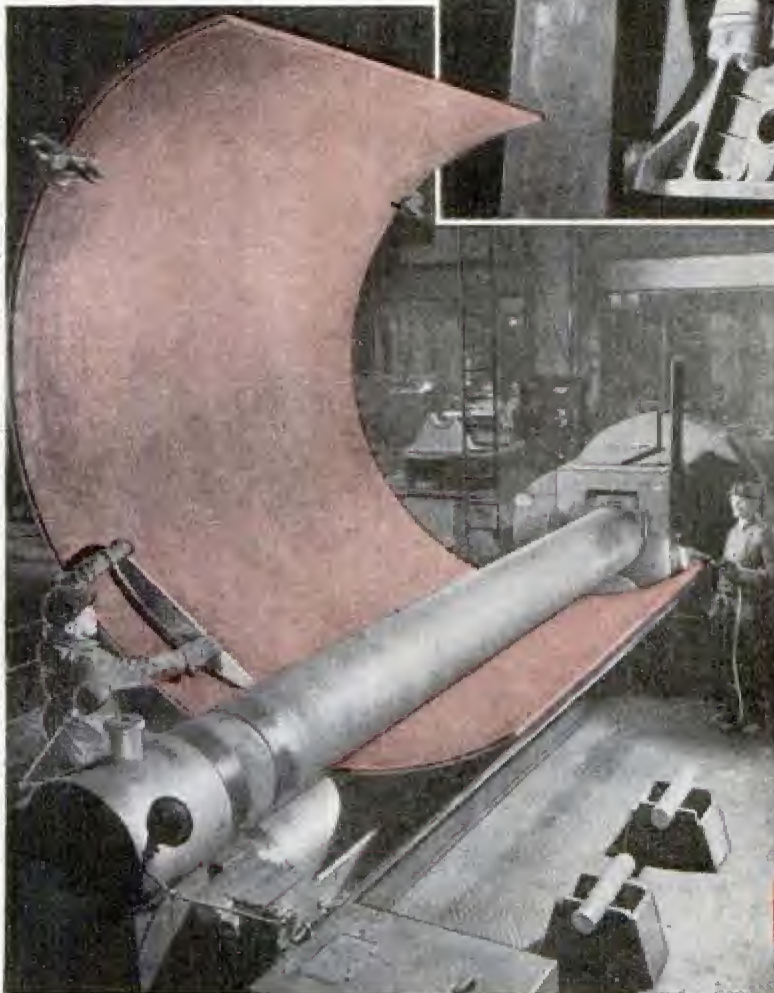
giant battleships and more than 1,000 heavy bombers thrown in for good measure.

As most people know, the amazing growth of the steel industry since the start of the war is one of the great wonders of the industrial world. Right now, close to 95 million tons of steel ingots and castings can be turned out annually, which is nearly twice as much as in the first world war and far ahead of the biggest peacetime output of 63 million tons in 1929. The added capacity built in the last few years alone is nearly two-thirds as big as the entire industry in England.

No one will dispute that the steel industry has been one of the biggest single factors in win-



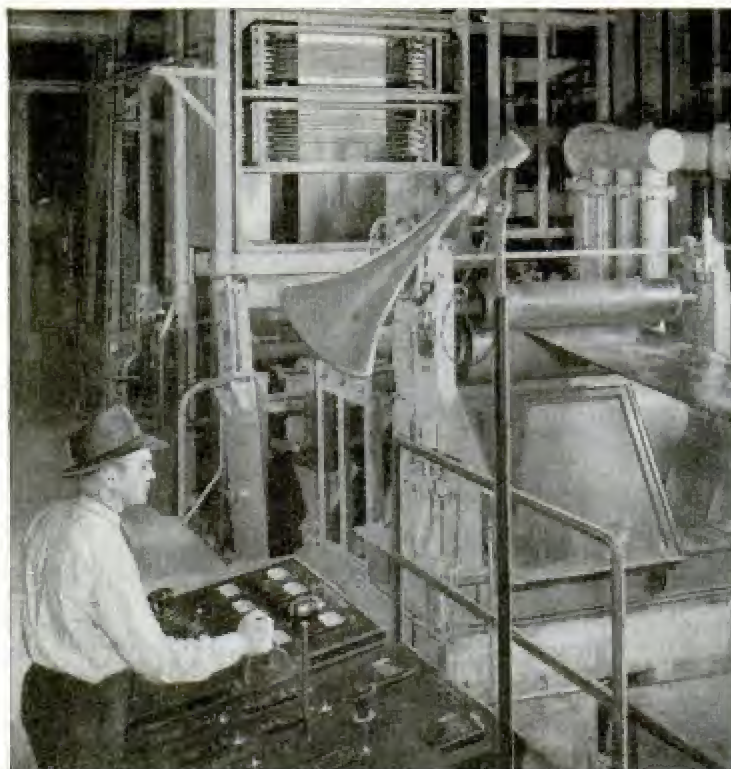
Above, 27 tons of steel went into skeleton of a waterwheel generator. Left, a giant "wringer" curves steel frame of turbine generator through cold rolling
Westinghouse photo



ning the war, but many wonder how this giant new steel-making capacity will be used after the war is over. Where will all the steel go? What new uses of steel will be found? What about competition from plastics, glass, synthetic rubber, the light metals, aluminum and magnesium, and other materials?

Some of these questions are more easily answered when it is considered that steel continues as the world's basic engi-



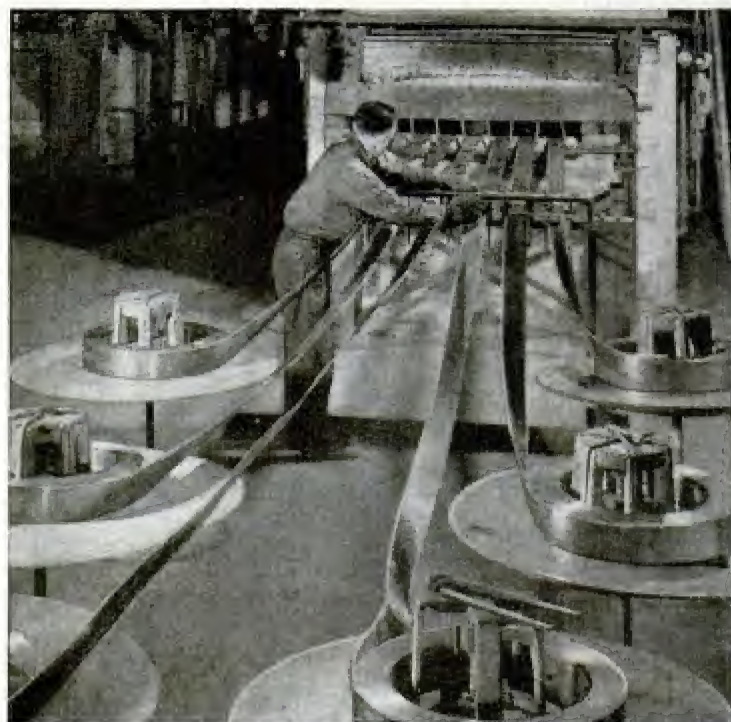


Republic Steel Corp.

Induction unit melting tin and fusing it to a steel strip base

neering material, and will be just that for years to come unless productive capacities of other materials are increased to far beyond present levels.

It has been estimated that America will be able to produce 96,000,000 tons of steel every year after the war compared to only 6,000,000 tons of glass; 1,500,000 tons of copper; 1,500,000 tons of aluminum and magnesium; 1,000,000 tons of zinc; 1,000,000 tons of lead;



1,000,000 tons of plywood; 1,000,000 tons of synthetic rubber, and only 200,000 tons of all types of plastics. Steel comprises 85 percent of all materials and 95 percent of all metals.

But even though there will be far more steel available than all other materials combined, the steel industry is making rapid progress in finding new uses for steel, developing new alloys, and working closely with other



Above, 50,000-gallon watersphere is built entirely of welded steel. Left, stainless steel strips leave "payoff" reels to enter the annealing furnace
Photo from U. S. Steel Corp. Subsidiaries

industries in finding ways that steel can be used along with other metals, glass, plastics and rubber to produce new peacetime products ranging all the way from home appliances and personal items to huge buildings, bridges and important public works proj-

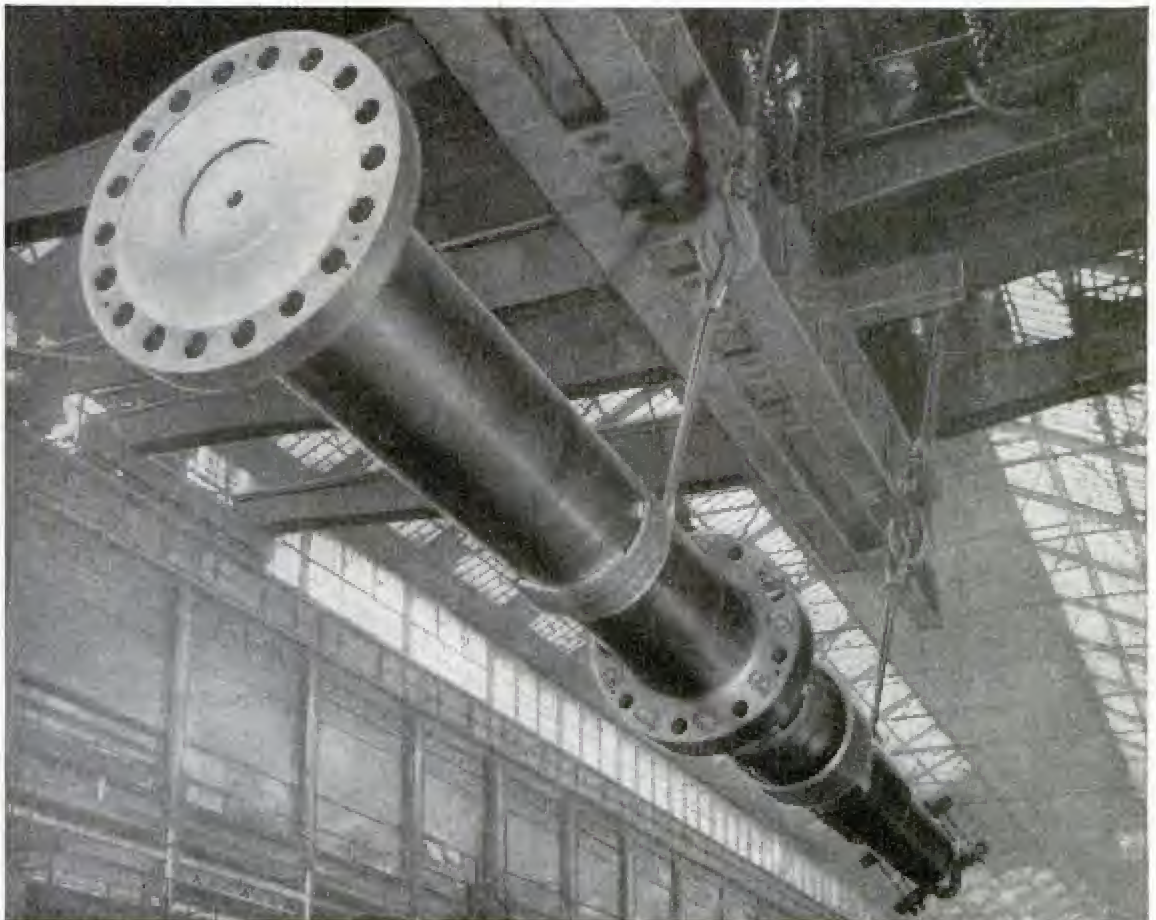
ects badly needed throughout the world.

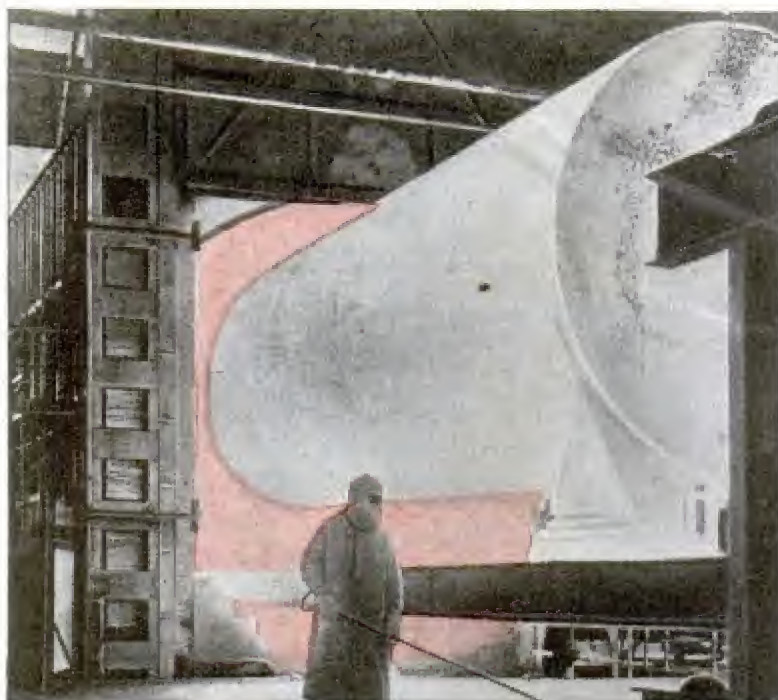
Many of the new alloys used in war materiel still are closely guarded military secrets. It is known, however, that they have improved toughness, hardness and strength and given greater resistance to heat, corrosion, abrasion and impact shock. In one instance, cobalt was added to a low-tungsten molybdenum steel analysis to give a high speed steel of maximum hardness for heavy duty work. In other cases, steels requiring smaller amounts of alloys have found widespread use, and the alloy-saving NE (National Emergency) steels developed since the beginning of the war now are used in practically every piece of Army equipment specifying alloy steel.

Steel also is being plated far more effectively and with far more speed as a result of new electroplating methods using cadmium, one of the best coatings to prevent corrosion, and tin for containers. A new DuPont development makes it possible



Above, inspecting surface of tin plate. Below, the 150-ton shaft which is part of the first Grand Coulee Dam's waterwheel generator, largest in the world





Worker wears special suit as stainless steel tank emerges from furnace

ifications for cartridge belt links that tie bullets together as they race through .50 caliber machine guns at 800 shots a minute without jamming. To impart perfect workability in these links, the steel is bright annealed in furnaces of special and improved design so that the fabricator can set dies and machinery for top-speed production with full confidence that he will get precise results.

In addition to great quantities of steel needed after the war for automobiles, farm implements, refrigerators and other high production items, the steel needed for structural purposes is expected to be increased by advances made in prefabrication of housing

units and by greater use of welding in all forms of construction. While the prefabricated home of the future is likely to contain numerous structural materials besides steel, its basis probably will be a steel framework. New production processes may bring thin copper or brass layers rolled onto steel sheets, offering the strength of steel plus the surface beauty of copper or alloy at small cost. Similar arrangements with plastics as ve-

units and by greater use of welding in all forms of construction.

While the prefabricated home of the future is likely to contain numerous structural materials besides steel, its basis probably will be a steel framework. New production processes may bring thin copper or brass layers rolled onto steel sheets, offering the strength of steel plus the surface beauty of copper or alloy at small cost. Similar arrangements with plastics as ve-

to use cadmium in coats 50 times thicker, and thus give greater protection to the steel surface. A recently introduced electrotinning process puts steel strips through a maze of machinery and chemical baths at 1,000 feet a minute with a better and more uniform coating of tin than ever before and saving more than 4,000,000 pounds of tin a year.

In working out ways to use steel instead of other metals for war products, metallurgists have developed metals that will be of great peacetime value. The type of steel used in cartridge cases, which saved in one year more than half a billion pounds of copper, undoubtedly will have many post-war uses. Many things also have been learned about making cold rolled strip steel. One instance involved exacting spec-

Right, giant wind turbine near Rutland, Vt., is capable of generating 1,000 kilowatts. Below, one of its huge stainless steel blades is trucked to the site

Electro Metallurgical Co. photo



neers over steel may be even more popular because of the variety of surface colors and effects that can be obtained. Combinations of plywoods and steels also are said to have possibilities. Steel framing systems for housing have been developed in a range that includes industrial and municipal buildings, multiple dwellings, group housing projects, cottages, boat houses, plane hangars, cabinets, summer houses and many others. The light-gauge steel now used has characteristics which serve equally well in all types of construction, forming a rigid framework which will not sag, gives resistance to termites and rot, and is light enough to handle easily.

In prefabricating and welding larger structures, much has been learned from war experiences in shipbuilding. At least one prominent welding authority—J. F. Lincoln, president of the Lincoln Electric Company—believes that eventually the use of rivets will disappear entirely.

"There is endless opportunity in the direction of finding new uses for steel," he says. "Uses in place of castings, forgings, malleable iron and wood are apparent and have been urged for years in some parts of the industry. The steel industry must, of necessity, force these uses if it is to keep operating at highest capacity. This means steel houses, fabricated steel parts and new alloy steels for new purposes which will enormously increase the places where steel would economically be applied."

There is said to be a full potential market of more than 25 million refrigerators, nearly 20 million washing machines, and 21 million cooking ranges from now until 1950. If the potentials are realized, around 5,000,000 tons of steel will be needed.

Far greater use of stainless steel is forecast. New methods are said to increase the flow-ability of stainless steel and make it more workable in press dies. If stainless steel does come into greater use, it will become one of industry's most useful metals, since already it has more strength for weight than any other material in common use and does not rust or corrode. Providing lighter sections in structural assemblies without sacrifice of strength, stainless steel likewise gives resistance to heat.

In connection with a statement by C. F. Kettering, director of research of General Motors, that the all-steel airplane will come before the aluminum automobile, it is notable that the first stainless steel commercial airplanes give excellent service.

Steel parts also are being made in huge quantities with the utmost precision. Millions of lustrous, mirror-finish steel balls for frictionless bearings now approach absolute roundness. Made of electric furnace

Continued to page 150

Expansion Bits of Different Sizes Drill Hole a Foot Wide



By means of a series of various-sized expansion bits made up for the purpose, a power tool can drill holes up to a foot in diameter. A guide hole is drilled first with a one-inch bit. A three-inch expansion bit, mounted on a piece of one-inch stock that fits into the guide hole, is then used to increase the width of the hole to three inches. A six-inch expansion bit, mounted on a three-inch guide, enlarges the hole again and the process is repeated with nine and 12-inch bits. Countersinking also may be done with the bits.

Dentists Freeze Patient's Jaw To Kill Pain From Drilling

Experiments by the United States Naval Medical Research Center presage refrigeration of jaws in place of the use of drugs by dentists to kill the pain, according to the Journal of the American Dental Association. Sixteen sailors and Waves volunteered for the experiments, in which 22 cavities were filled under local refrigeration at the freezing temperature of one or two degrees Centigrade. Complete anesthesia or loss of sensation was obtained in 15 instances, while in seven a mild degree of pain was felt.

Lt. Comdr. J. S. Gostarowski 55

CRACKING- DAVY JONES'S LOCKER



Above, right, diver inspects underwater suit and helmet. Above, attaching shackle to end of 12-inch towing line on rescue ship. Below, LCI high above high tide, ready to make half-mile overland "cruise" to beach for refloating



AFTER the war, you might suppose, will come the giant task of raising from the sea the hundreds of ships that have been sunk by military action. Millions and possibly billions of dollars worth of ships and cargoes are lying on the ocean bottoms.

Yet the opinion of deep sea salvors is that most of these ships will remain where they are for all time. Most torpedoed vessels sank well offshore and lie at depths where they can't be reached. Even ships that lie in the comparatively shallow waters of the continental shelves won't be touched. We will have more good ships than we will know what to do with when the war is over, and prices for scrap metal will be too low to warrant raising ships for their value as scrap. Only in isolated cases will salvage operations be worthwhile.

But wrecks that will be literally worthless tomorrow are infinitely precious today if they can be salvaged, for right now America needs every cargo carrier that it can obtain. Raising, patching, and repairing a wrecked ship is the same as building a new one without expenditure of materials.

Ship salvage men now are busier than ever before. They have gone out into the middle of the



Atlantic to tow back vessels that were crippled but not sunk by submarines and they have raised and repaired German, Japanese and Italian vessels that were sunk. Many of their jobs are done in active war zones and they sometimes work behind the protection of warships, screened overhead by blimps or airplanes.

Salvage operations are performed either by trained Navy crews or by crews of civilian experts who work under contract with the Navy. Navy salvors alone have been credited with recovering some 6,000 tons of lead, copper, rubber, and other vital materials from the sea, in addition to sufficient iron and steel to build two heavy cruisers.

Salvage men tackle big jobs like the raising of the "Normandie," but they are just as concerned with recovering and putting back to work little ships that literally could be placed on the "Normandie's" deck. An odd example of salvaging a small ship occurred when an LCI troop carrier went ashore broadside to the beach on an island off the west coast. Subsequent tides put the vessel up on the rocks.

LCI after it had gone ashore broadside to beach. Cables held it in place as tide pushes it farther up the beach. Below, preparing to fire hand line from rescue ship so that a larger line can be attached. It in turn will be used to pull heavy cable to ship being salvaged





Radio man (above) on rescue ship converses by walkie-talkie with salvage crew. Below, tiny salvage tug next to sinking steamer

Salvage men decided that it would be too risky to drag the ship back down to the water at that point and so they made the vessel cruise for half a mile overland under her own power to a beach from which she could be re-launched with safety.

A roadway was built, timber tracks were laid on the road, rollers were put under the ship, and then the LCI dragged herself forward by means of her own anchor winches, hauling on lines attached to sand anchors up ahead. The troop carrier moved overland and down to the beach, dragging herself into the sand at low tide so that she was partially afloat when the tide came in. Then a salvage vessel pulled her safely into deeper water.

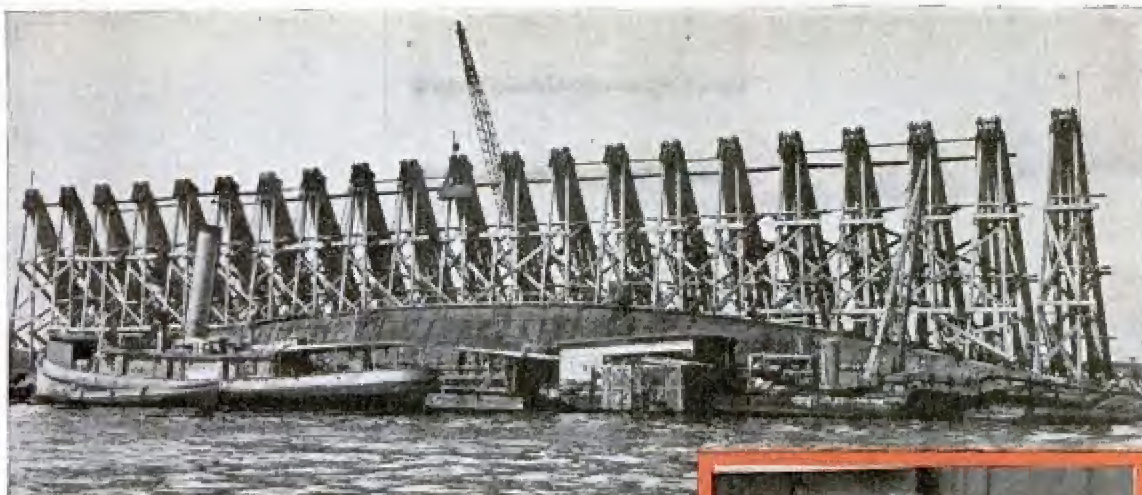
When the war turned ship salvage from an occasional episode to a steady occupation, the Navy developed a special rescue vessel known as the ARS type. This is a large ocean-going tug especially designed for salvage

work. One of them seems ridiculously small compared to a great ship that it may be assisting, and yet it carries specialized equipment by which ships many times its own size can be raised from the bottom or safely removed from a rocky shore.

Steam or Diesel driven, these rescue ships are equipped with machine shops, carpenter shops, and blacksmith shops. They have hoisting winches capable of pulling 10-ton loads, they have large capacity air compressors and they carry elaborate fire fighting equipment. On deck are 12-inch Manila hawsers for towing, and 8,000-pound kedge anchors of special design. At least one diver is a member of each crew.

Coils of chicken wire, walkie-talkie radio sets, hand shovels, and ordinary building lath are among the important odds and ends of equipment that the rescue ships need and always carry with them. The chicken wire is handy when pumping out a ship, for it can be fashioned into a





Above, U.S.S. Oklahoma, sunk at Pearl Harbor, is raised with help of timber frames. Right, rescue ship's kedg anchor which is dropped and pulled against in hauling vessels off shore
U. S. Navy photo

strainer that prevents debris from clogging the pumps. Walkie-talkies speed up communication between the rescue vessel and the salvage crew at work on the wreck. Shovels are needed when the salvage men bury "dead men" ashore as anchor-ages. The lath is used to help hold in place the large felt blankets that serve to temporarily patch a hole in a ship's side.

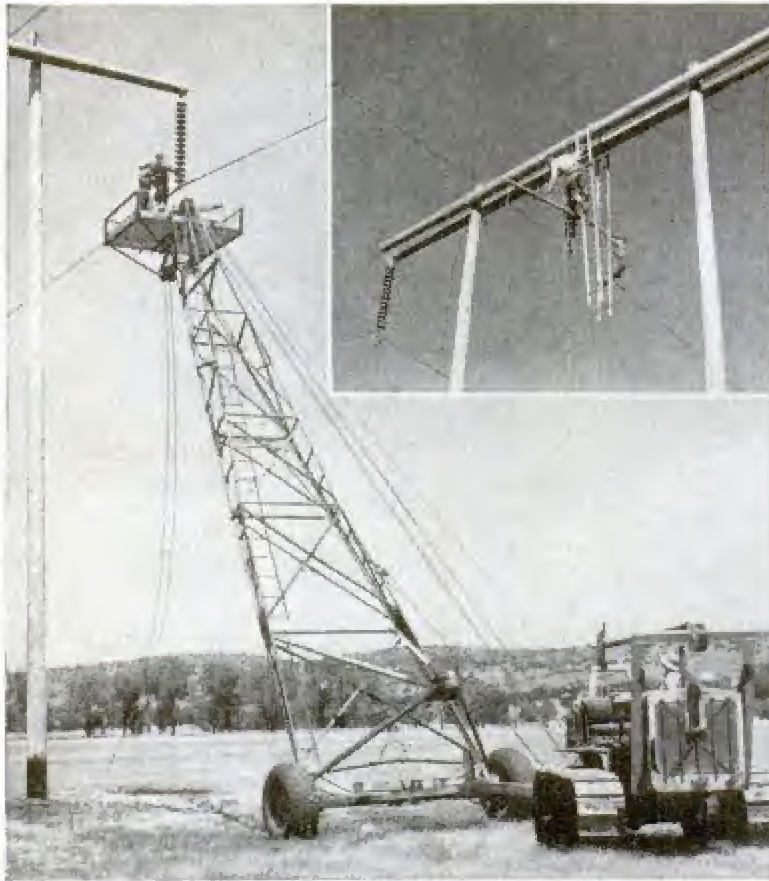
Every salvage job is different although salvage men say that they merely "patch 'em, pump 'em out, and tow 'em in." Usually the patching is an

Continued to page 150



Below, lifting bow of U.S.S. Turner, ripped apart by explosion





'Sky-Ride' Platform On Erection Rig Holds Linemen

An erection rig topped by a high platform speeds the work of power linemen on the Shasta Dam-Oroville transmission line in northern California. The rig is moved by a Caterpillar tractor and enables workmen to do a two-hour job in 45 minutes. The "clipping" operation for which the platform is used consists of removing the conductor from a cable sheave, wrapping it with armor rods, placing suspension clips and securing them to insulator units. The new method for "clipping" was developed by U. S. Bureau of Reclamation engineers. Formerly, linemen used ladders and safety belts—a more spectacular, but slower method.

Six-Motor Bomber Unveiled by Nazis As Their "B-29"

Germany's largest bomber is the six-motor BV222 Viking, according to a report from Stockholm, Sweden. Hoping the plane will offset the U. S. Army's B-29, the Nazis announced that the Viking has a length of 111 feet, which is 13 feet longer than the B-29, and has a wing span of 138 feet, slightly smaller than that of the Superfortress. It was said the giant has machine guns facing in every direction. No other details were given.



Glass-Plastic "Sandwich" Stronger Than Metal to Be Used in Luggage

Glass-plastic "sandwiches" which are stronger than metals will be available for use as lightweight luggage, molded office and home furniture, and prefabricated kitchen and bath units after the war. The new material, developed by the Army Air Forces to fabricate fuselage and tail sec-

tions for airplanes, can be formed into large intricate shapes at low pressure without using costly molds. It is a combination of glass fibers and special plastic resins. Strength-weight tests show the "sandwich" is 50 percent stronger than aluminum and 80 percent stronger than wood.

Plastic "Raincoat" Sprayed on Planes Like Paint

Right, plane with a "plastic raincoat," which won't crack at 30 below zero or 180 degrees above. Below, a plane is sealed by plastic spray



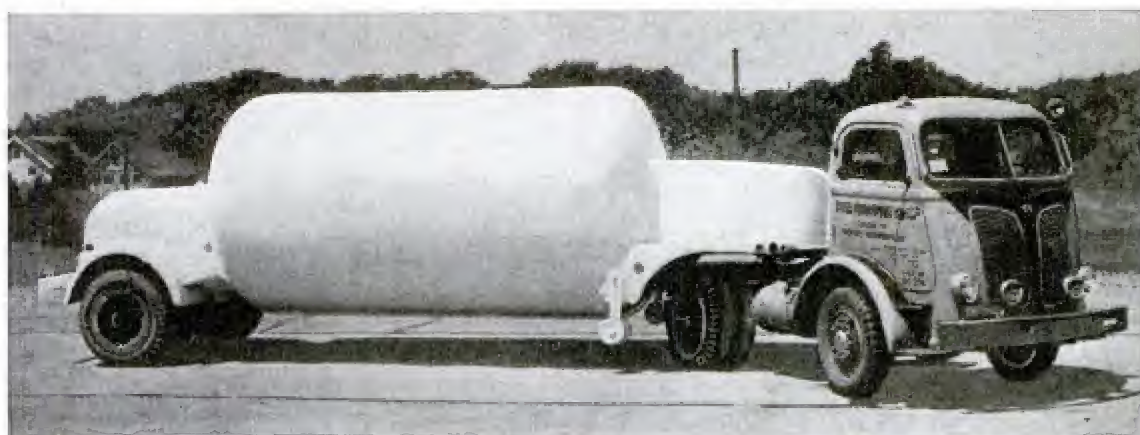
War planes, which are often shipped overseas on open decks, are protected against corrosion with a plastic "raincoat" that is sprayed on. The liquid spray dries in less than 30 minutes, forming a paper-thin coating which seals the entire plane. When the plane arrives at an advanced base, it takes only half an hour to peel off the plastic coat. The peelings can be ground up and used again.

"Bottle" Trailer That Hugs Road Hauls Liquid Gas Safely

034-3

To add safety and economy to the transportation of liquefied petroleum gases, the Heil Company, of Milwaukee, Wis., uses low-slung "trailerized" units. The gas tank is suspended between the axles of the trailer and the tractor so that, fully loaded, the tank is only 18 inches above the ground, providing a center of gravity lower than that of conventional tank-hauling units. The advantages are a safer, more compact highway carrier, which is easier pulling, has less side sway and reduced wear and

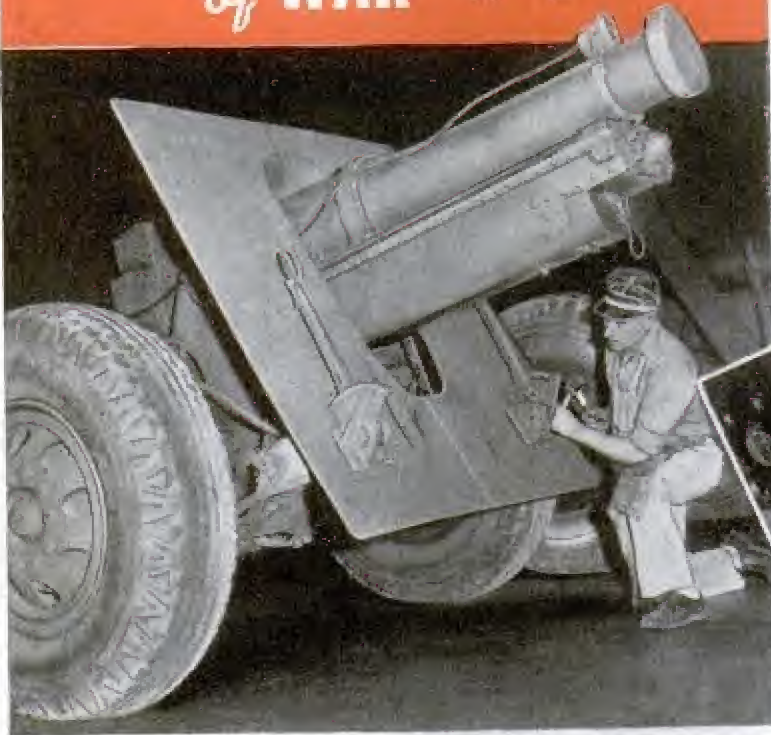
tear on the tires. One of the unit's unique features is that the payload's center of gravity can be moved forward or backward to maintain desired axle or king pin loadings. Maximum payload is 4,000 gallons and the tank is equipped with safety valves which blow at 225 pounds pressure in emergencies to release the load in the form of gas. The unit transports butane, propane and other liquefied gases which are used extensively in the production of synthetic rubber and high-octane gasoline.



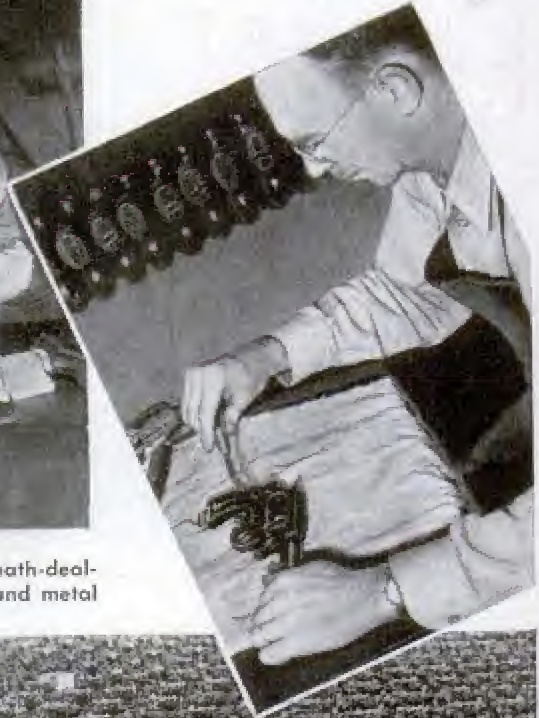
Suspending the payload between the axles has eliminated over a ton of dead weight in this "trailerized tank"

REPAIRING *the* TOOLS of WAR ☆ ☆

Putting the "fight" back in military equipment damaged in battle is one of the big jobs now being performed in Army arsenals in the United States. Giant 155 mm. howitzer (left) is made new again at Benicia Arsenal in California, one of the largest repair depots in the world. Everything in ordnance, from field guns to revolver (below) is repaired and tested at the depot



The 40 mm. antiaircraft gun tubes (below) get a new lease on death-dealing for enemy planes in arsenal shops. Repair job saves time and metal



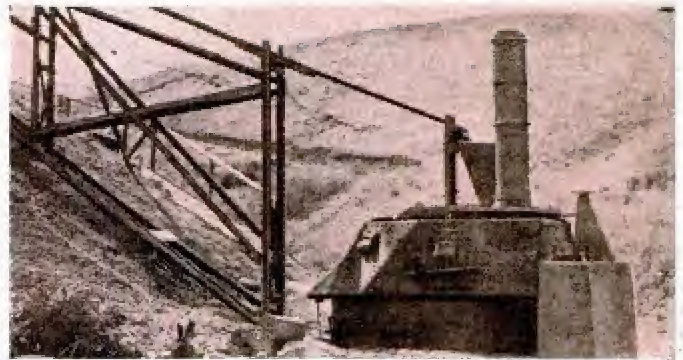
*Benicia Arsenal
Calif*





Exploding defective shells or explosives is all in the day's work at arsenal. Above, an electric exploder blows up a defective bangalore torpedo. Below, an imposing array of rebuilt equipment ready for re-shipment abroad to battle zones. Here are limbers, air borne howitzers, antitank guns, antiaircraft guns—all good as new

With his thumb on switch that cocks and fires weapon, an ordnance expert tests .30-caliber gun in an underground gallery



Salvaged M-3 tank with smokestack on top serves as exploding chamber for defective primers and fuses carried on an endless belt. Below, test firing carbine in the underground gallery



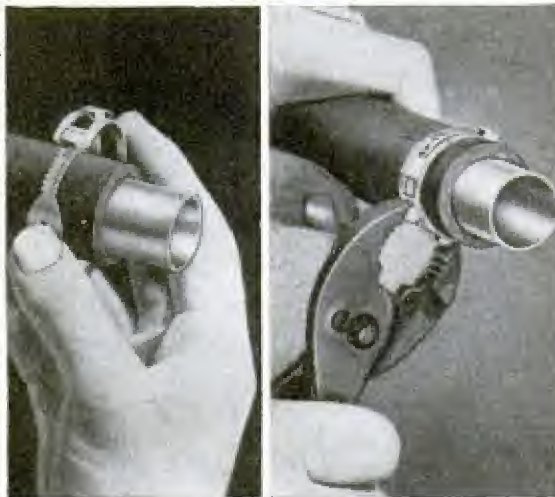
Self-Rising Lightweight Plastic Forms Non-Heat Insulation



With a versatility surpassing that of the Army jeep, plastic materials have entered a new field—insulation. Foam plastic, developed by General Electric engineers, is said to have a lower heat conductivity than cork or rock wool insulation. A unique characteristic of this lightweight plastic is that it is self-rising, no heat being required in the manufacturing process. The material begins to foam and expand two minutes after it is stirred. Foam plastic weighs only 1½ to 2 pounds per cubic foot.

Simple Clamp for Rubber Hose Locks With Ordinary Pliers

Using no gears, thumb screws, or intricate locking means, a one-piece hose clamp



may be snapped over the hose into a pre-latched position by hand. The final lock is made with ordinary pliers. The clamp, which is made for lower pressure connections and has a lower profile, is light in weight and exerts an even pressure around the circumference of the hose.

Synthetic Sugar Solves Puzzle Of How Nature Makes It

After 50 years of experiments, synthetic sugar which is identical with ordinary commercial sugar has been produced by chemists. Two grams of pure crystalline sucrose—the sugar which is formed naturally in sugar cane, sugar beets and other plants—were recently produced by three University of California chemists. Fructose, or fruit sugar, and phosphorylated glucose were used in the process with a bacterial enzyme as reagent. Too expensive for practical production, the process shows the chemical mechanism by which nature forms sugar, and may lead to obtaining greater yields from beets or cane.

Handy Attachment Grinds Drills At Three Different Angles



Old drills can be quickly and accurately ground by an untrained workman with an adjustable grinding attachment. It grinds drills at three different drill point angles, and can be used on those ranging from ⅜ inch up to 1¼ inch in diameter. The drill is placed in a swinging trough mounted on a tilted post. An adjustable rod can be lifted out and screwed in the bottom end of the trough to accommodate drills 11 inches long. The device can be used with a bench grinder or with a floor grinder if a bracket is provided.

CAMERAMEN UNDER FIRE

By Paul Healy

Part I

THE dramatic war pictures you take for granted in your daily newspaper and in the weekly newsreel often were made under almost impossible conditions and in the teeth of enemy gunfire. They were taken by the unpublicized heroes who are willing to go anywhere and risk any hazard to obtain for the folks at home vivid close-ups of the hard facts of combat. Some of these cameramen are soldiers, sailors and marines trained to defend themselves, while the others are unarmed civilians who must dodge snipers and machine gunners as best they can.

The life of a front line photographer is considered



Above, marine combat cameraman inches forward on his stomach to get close-ups of a battle. Below, marines stooping low in the face of a deadly barrage charge in single file across a beachhead on Tarawa. The cameraman who took this picture followed right along with them
U. S. Marine Corps photos





Above, dressed in sheepskin and high-altitude oxygen mask, an Air Force combat cameraman looks like this when he puts a bombing mission on film

so rugged that Martin Barnett, Paramount News cameraman, says he frequently discovered veterans in the New Guinea area staring at him in perplexed amazement. They wanted to know why he, as a civilian, was obliged to suffer the rigors of combat in the tropics.

"It's my job—I asked for it," Barnett always replied.

"You mean you like this kind of work?" they exclaimed. "You mean you could go

home where it's safe and comfortable and you don't want to?"

Nevertheless, Barnett found that the troops were always glad to see him coming, for it meant that millions of American citizens were going to get a realistic picture story of what the Allies were up against in the Pacific. Like other cameramen, Barnett insisted on going wherever the fighting men went, loaded as he was with heavy photographic equipment. During the Buna campaign early in the war he lived in quarters which were bombed and strafed every evening for 12 consecutive days.

Barnett suffered such a serious injury while making his complete movie record of the first assault on Lae that it caused him to be shipped home. Aiming his camera from the "conning tower" of an LCI (landing craft, infantry), Barnett was riding into the beach with the first wave of Australian forces when three Jap bombers broke through the air umbrella and scored a near miss. The concussion flung him to the deck of the ship, injuring his spine.

Navy photographer caught this explosive action from deck of a carrier during a task force raid on Saipan





U. S. Air Forces photo

Air Force cameramen shoot a movie record of air action off Munda Point in the South Pacific

Heroics which win a writer a by-line rarely win similar recognition for a cameraman, yet several war photographers have become nationally known through their individual exploits. One is Frank Filan, of the Associated Press, who won the Pulitzer Prize for the best war news photo of 1943. The picture, made during the battle of Tarawa, showed marines examining the remains of what once had been a Japanese stronghold, with the bodies of dead Japs strewn grotesquely among the rubble.

Filan's job had not been easy. When the assault boat in which he was being carried ashore sank, he seized his heavy pack and started bucking the shoulder-high surf, then turned back to assist a wounded marine. Together they covered the perilous 600 yards to the beach but several times the cameraman slipped and went in over his head, ruining his cameras. That night Filan filled in as a stretcher bearer carrying wounded marines from No Man's Land to the doctors behind the lines. Then he borrowed a camera from a

Coast Guard photographer and made his award-winning photo. He was commended by Adm. Chester Nimitz for his "inspiring devotion to duty."

The first famous World War II combat pictures were made on Dec. 12, 1937, by Norman Alley, a veteran newsreel man, standing on the deck of the United States gunboat Panay as Jap bombs exploded all around him. Alley's reels were considered so valuable as a historic



Left, press "fotog" shares a foxhole with a doughboy



Above, Lewis Cass, Paramount newsreel man, keeps a sharp lookout for snipers as he prowls among ruins at Castelforte, Italy. Below, the camera captures fountain-like effect as an allied ammunition ship blows up after air attack in Gela, Sicily, harbor

document of the unprovoked sinking of the ship that they were insured for \$350,000 and convoyed under armed guard all the way to Washington, where they were studied in the White House. The cameraman was given a medal by Congress for his work in aiding the Panay wounded and an award from the National Headliners club for making the best photos of 1937.

Since then Alley, who learned his job as an army signal corps photographer in France during the first world war, continued to set the pace for front-line cameramen. He covered the Russian war in Finland and was present when the German army marched into Norway, Holland and Dunkirk, later smuggling out the only picture of the bombing of civilians made in Nazi-held Europe; when America went to war, he followed the shooting from the Marshalls, to New Guinea, to Guadalcanal, to Sicily, and to Italy. Watching the invasion of Salerno from a destroyer, he stayed within 15 feet of the bridge for 72 hours and shot 7,000 feet of film, including the first picture of a German glider bomb exploding.

Eugene Smith, a magazine photographer who flew over the islands of Tarawa, Truk, Kwajalein, Eniwetok and Tinian, also contrived to be at the right spot on many occasions. One day, returning from a bombing run over a Jap atoll, Smith heard an excited pilot's voice in his ear phones: "Mid-air collision! Mid-air collision!" As his plane banked and turned,



Smith raised his camera to the hole in the Plexiglas in time to catch two big puffs of smoke on the water. It was the only picture of the death of Raymond Clapper, newspaper columnist, and was widely published in newspapers and magazines.

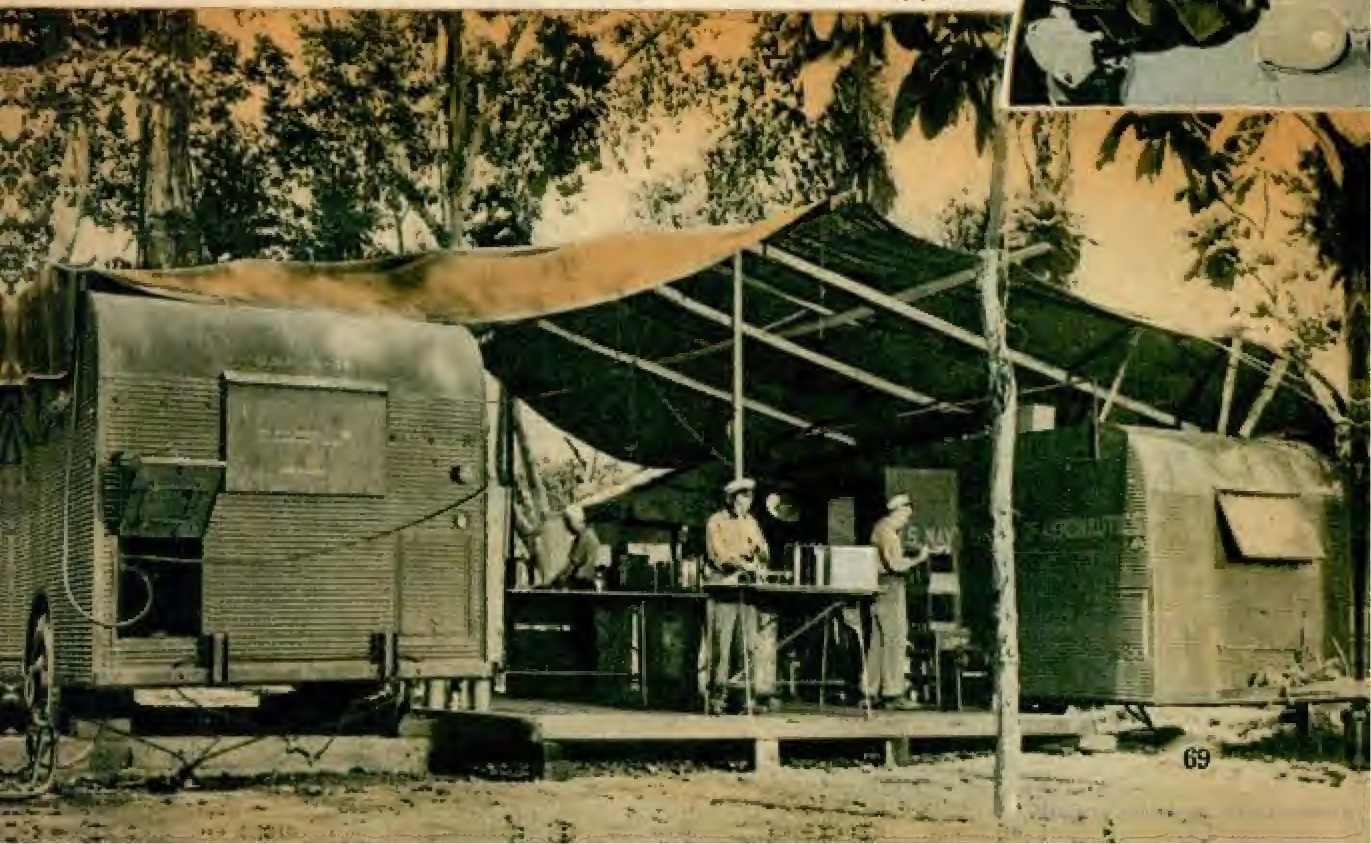
The primary job of the great numbers of combat cameramen trained by the army, navy and marine corps is to act as the "eyes" of the tacticians and the strategists but a good share of their work is released to the public through the roto picture pool, a noncompetitive wartime set-up in which every publication and every newsreel company is entitled to use any picture made by any cameraman, military or civilian.

Servicemen-photographers, who are equipped to fight if they have the opportunity, shot their pictures and dispatched them to the laboratory so fast during the invasion of Normandy last June that the United States received the first still photos just 36 hours after the battle of France had started. The first invasion motion pictures arrived 28 hours after that.

Continued to page 158



Top, huge aerial camera in action. Center, bearded marine cameraman in action during battle of Tarawa. Below, photo-trailers for developing pictures on Guadalcanal
U. S. Navy photo



Saulbridge, Mass.



Polarized Light Tests Lenses Toughened by Heat Process

You can look inside a piece of glass with polarized light to determine its degree of toughness. This method is being used by the American Optical Company to inspect lenses for safety goggles. The black pattern which shows up under polarized light reveals the strength of the shatterproof glass. Finished lenses are toughened by reheating and then cooling by compressed air. This increases resistance to the impact of flying particles by 400 percent.

Electric Finger Finds Needle Inside Woman's Heart

In a delicate operation which lasted more than two hours, a two and a half inch sewing needle was extracted from the ventricle of a woman's heart in New York City, the first such case in medical history, according to the New York Surgical Society. The instrument which made the feat possible was an electronic finger, surfaced with



stainless steel, and about as large as a human finger, though longer. A cord connects the finger to a meter whose dials show the presence of any metal near the finger tip. First the finger indicated the needle was in the back of the heart, then it guided the doctor to a line directly under which the metal lay. If the finger had been in error by as much as a hair's breadth, it would have necessitated two incisions—more than the heart could stand.

Stretcher That Folds Into Pack Makes Ambulance of Sedan

Because it may be doubled up and carried in the trunk when not in use, a folding stretcher can convert an ordinary sedan into an emergency ambulance. In addition,



the stretcher can be carried like a pack on the back, and folded at right angles it can be used to remove injured persons in nearly upright positions from manholes and other confined places. When carried as a pack, the leg straps are used as a harness. The stretcher also provides a means of securing the head with a bandage to immobilize neck fracture cases and an L-shaped attachment for traction splinting on either leg. Seventy-four inches long, it weighs only 16 pounds but can support 1,000 pounds.

6-Ton Bombs Start 'Tidal Waves'

Six-ton blockbuster bombs are used by the Allies to start "tidal waves" which engulf German shipping in harbors and boat pens along the coast of Europe. The bombs, which are capable of making craters in the earth 40 feet deep and 110 feet in diameter, stir up such colossal waves that E-boats, the counterparts of our PT-boats, are lifted out of the water and concrete boat pens are undermined. Boats up to 200 feet long have been badly damaged.

*Harpur J. Ranaburg Co. 234 Barth Ave.
Indianapolis 7, Ind. 0 257*

Electric Grid Dries "Tears" Left After Dip in Paint

Excess paint which collects at the drain-off points on dipped objects is removed with a high voltage grid. Formerly, these "fatty edges" or "tears" had to be corrected by hand. Grounded articles passed over the grid are de-teared by electrostatic attraction in 15 seconds to one minute. In coating steel cartridges, this method not only produces a smoother finish but saves thousands of gallons of scarce finishing material. The same principle, with a reverse application, is applied to spraying. The part is carried by a conveyor into an electric field where paint particles acquire a charge which causes them to be attracted to the article. This saves paint and produces a uniform coating.



Navy Spots "Cat's Eye" Vision With Luminous Dial Test

Normal night vision, vital for night flyers, ship's pilots and lookouts, is detected in a few minutes with a portable instrument developed by the Navy's Bureau of

Medicine and Surgery and the American Optical Company. The test consists of the subject's ability to see an object silhouetted against a luminous radium dial in a darkened room. The dial is in the lower part of the instrument's front panel, and a small red cross above it serves as a beacon. If the man being tested has normal night sight, he will be able to name the position of the opaque letter "T" on the dial as it is rotated. The dial is made of two pieces of glass between which is sandwiched a radium-activated luminous material. A neutral-colored filter before the glass reduces the light to an infinitesimal three one hundred-millionths of a lambert. Before taking the test, sailors and flyers wear special dark-adaptation goggles fitted with red lenses.



Southbridge, Mass.

Gasoline-Powered "Can Opener" Cuts the Ends Out of Oil Drums

By rigging what may be world's largest "can opener," the Navy Seabees in the South Pacific are able to cut the top and bottom out of a discarded steel oil drum in a single operation in less than two minutes. The same job done by three men by hand takes an hour. The cutting is done by a cone-shaped blade powered by a 60 horsepower gasoline motor. The drum cutter was given mobility by installing it on a trailer. After the drums have been cut open the Seabees use them as airfield and road drainage pipe, roofing shingles (after they have been rolled out straight), stoves, sinks, furniture, showers and toilets.

OCTOBER, 1944

*Edson
Baltimore, Md.*



0 292

SHOOTING BIRDS *with a* CAMERA



photography; that could mean any one of innumerable methods, even the crude boyhood trick of tying a thread to the camera shutter release and pulling it from a distance.

But after experimenting with many remote control plans (including the thread stunt), I decided the most practical and dependable system is a battery-operated solenoid—the magnetic coil device that operates your doorbell.

Why is remote control necessary in bird photography? The beginner often learns the answer the hard way. He learns that birds are frightened by any

Camera two feet from nest, controlled from blind 30 feet away, caught cardinal feeding its baby

By **Hal H. Harrison**

President, Audubon Society of Western Pennsylvania

"**H**OW in the world do you get so close to those birds?"

That question is part of the routine of my work as a wild bird photographer. I can expect it almost every day, just as I can expect my interrogator to look a bit startled when I answer:

"I don't!"

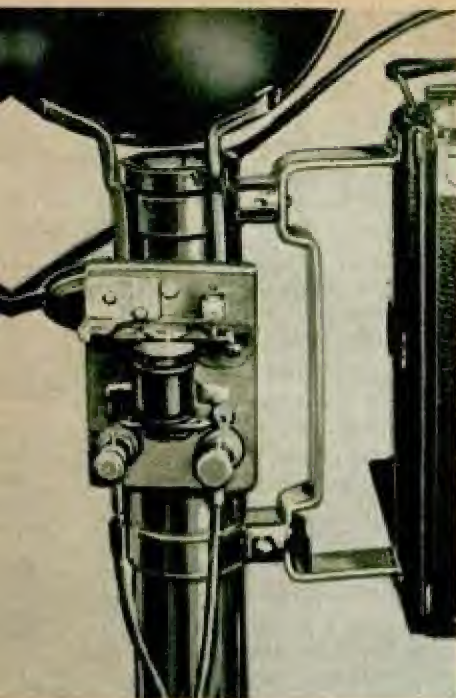
Mine is a remote control method of bird



The shy Virginia rail above took an hour and ten minutes to decide the camera three feet from its nest was harmless. When it returned at last, the photographer hidden in a distant tent blind (at left) shot the picture

Write to Mr. Harrison
% Camera Club





Above, the magnet used in remote-control system. Synchronized photoflash and shutter are fired at any distance by closing circuit. Right, robin family poses for photographer sitting in auto

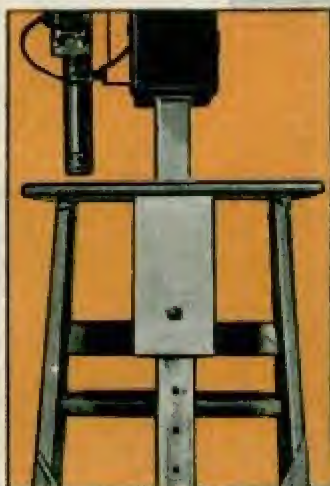


strange thing that moves, but generally will come to accept a strange thing that is inanimate. Thus, a bird would never approach a photographer, but in most cases it will ignore a camera provided the operator is not in sight.

If the photographer has a telephoto lens, and if his subject is in good light where the shutter may be operated at a speed fast enough to stop movement, a bird blind may be used to hide both the camera and the operator. But since this method is not possible for the majority of amateurs, the remote control system is more practical.

When the photographer operates his apparatus at a distance, the picture must be planned. The bird must be decoyed to appear in a satisfactory pose in front of the lens. The nest is the most commonly used decoy, for the bird instinctively returns to its nest, especially when there are

Camera is mounted on post secured to ladder, with holes every few inches to permit adjusting height of camera to focus on nest





mote control outlet, 50 to 100 feet of insulated wire, and a dry cell battery or two.

The battery is carried with the photographer to his hiding place some distance from the camera. I often use a tent-blind for concealment. One end of the wire is connected to the battery in such a way that the circuit is open. When the picture is to be taken, the circuit is closed. The other end of the wire is connected to the magnetic coil. Mine is a home-made affair mounted on a small board. On the other side of the board are the two prongs of the plug that fit the remote control outlet in the battery case on the camera.

The camera, mounted on a tripod, is focused on the spot where the bird is to be photographed. All apparatus is set up exactly as when a photoflash picture is to be taken and operated in the usual method of pressing the button on the battery case. When all is ready, the magnetic coil is plugged in and the long wire attached to it. The wire is strung to the dry cell battery, under the control of the photographer.

Tree swallow at left was caught by camera mounted on ladder. Cameraman trips shutter and flash by closing contact on terminal of dry cell, shown below

young to be fed. But an ingenious photographer will find other decoys that add variety: feeding stations, bird baths, singing perches, routes traversed when returning to a nest, nesting material racks, etc.

Very often, especially when nests are in heavy shade, the photographer is compelled to work in poor light. It is here that a battery-operated remote control is most useful. Synchronized photoflash is the solution to the lighting problem, and a remote-control outlet in the battery case is the ideal set-up.

The apparatus is quite simple. There are only three necessary pieces besides the camera and the ordinary flash gun with a remote control outlet: the magnetic coil that plugs into the re-



Camera is trained on spotted sandpiper's nest; wire connects it with battery in car

When the bird is in position, the circuit is closed, and the solenoid principle operates the synchronized photoflash in the same manner as it rings a doorbell.

It is helpful, but not necessary, to use binoculars or field glasses to watch the subject from a distance. In the case of small birds that are very active, these glasses are particularly desirable in determining the exact second when the circuit should be closed to shoot the picture.

To reach tree-nesting birds above the range of the ordinary tripod, I have constructed "tripod tops" on four different size ladders. A square hole was made in the top of each ladder. A square box with the center the exact size of this hole was placed under each ladder top. One hole was drilled completely through the sides of each box. A three-foot post was made to fit snugly through the hole in each ladder top and to slide through the box underneath. At intervals of three inches, holes were bored through the post, matching in size and position, the holes in the boxes. A bolt slipped through the box and the post fastened the post at the desired height. On top of the post is a standard tripod screw that fits the camera. By using ladders of different height, and by adjusting the post, a convenient "tripod" is available for reaching nests 15 feet or more high. The fact that stepladders are used makes the camera easily accessible for focusing, changing film and bulbs, and cocking the shutter.

An efficiently operated remote control system is not a guarantee for perfect pictures of wild birds, but it is certainly a means of eliminating some of the heart-aches in the hobby.

Although many cameras can be used, it is well to own one particularly suited for this work. I have found that ground glass focusing gives more assurance of good composition and sharp focus.

A thorough knowledge of bird behavior will save the photographer hours, even days of wasted effort. It will also assure him that his work around nesting birds will not jeopardize the lives of his subjects.

Finally, there is the all-important matter of patience. I know of no way to eliminate the need for an ability to wait and wait and wait for the picture which on some occasions never comes. Birds are so unpredictable that there is no sure way of knowing that they will assume a satisfactory pose in front of the camera.

But perhaps it is this challenge to sportsmanship, possessed by almost every man, that makes the hobby of bird photography so intriguing. And perhaps that is why annually more and more hunters lay down their guns to take up a more difficult sport of hunting wildlife with a camera.



Lighted Magnifying Lens Is Aid In Locating Slivers

Old-fashioned methods for removing slivers in fingers or toes are outmoded with a scientific instrument which has a lighted magnifying lens. A splinter is quickly located under the lens and can be removed with a sterilized scalpel. This instrument, used in first aid departments of industrial plants, is especially useful in detecting fine slivers of "invisible" wire.

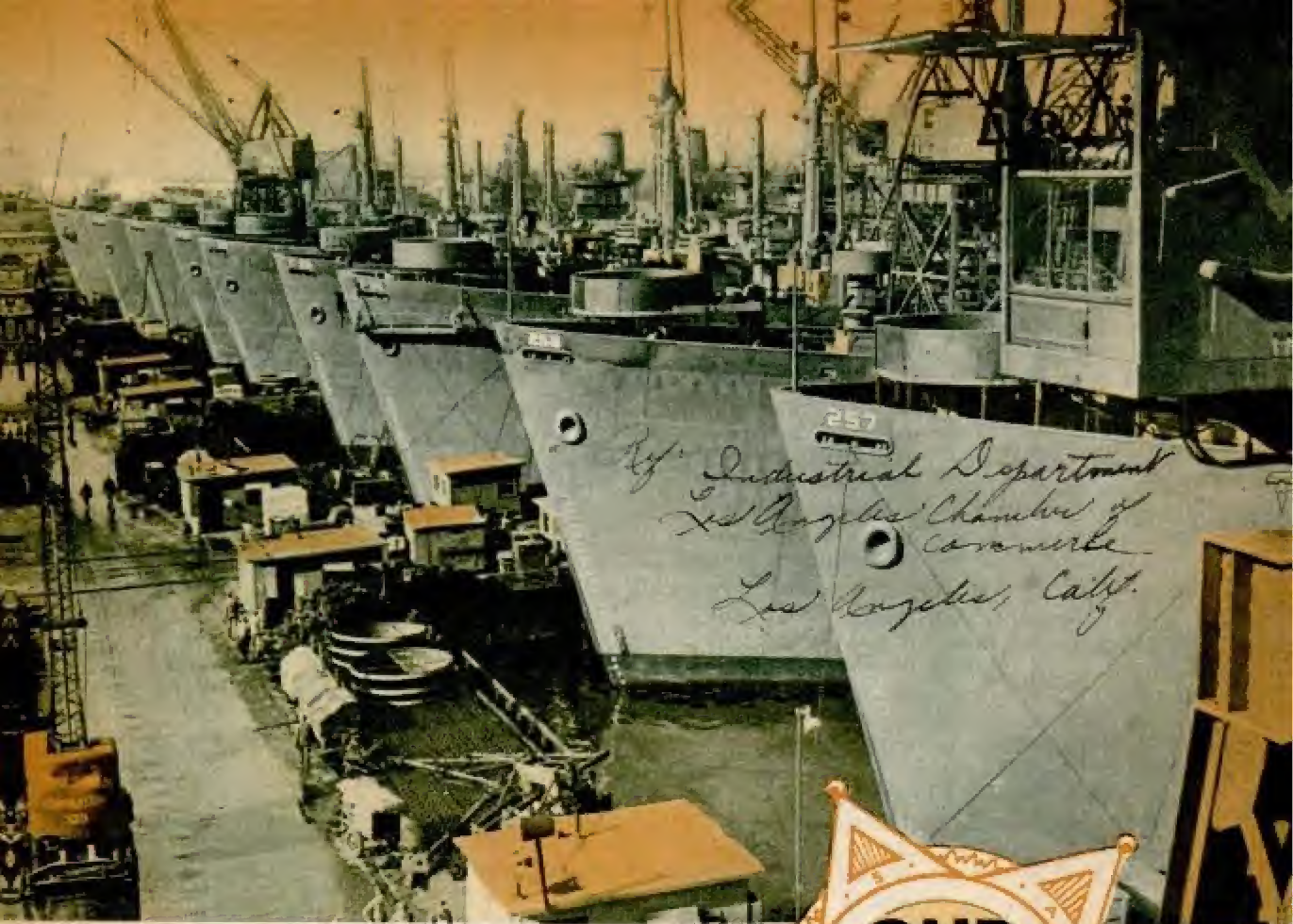
Radio Waves Sterilize Foods After They Are Packaged

High frequency radio waves, which are providing the heat for many intricate processes in war plants, also serve to sterilize packaged foods to prevent spoilage. The packages of food, such as flour or raisins, move on a conveyor belt through a "radio heat" machine called a megatherm. High frequency waves have a uniform heat penetration. With these waves it is possible to cook a steak rare in two seconds.



*Chippewa Pioneer Press
Bend Sin Gonsen
N. J.*

*Federal Polyphone Radio Corp.
252 South St.
Newark, N. J.*



Above, nine Liberty ships get finishing touches at Calship docks, Los Angeles. So many ships are being built on the Coast that putting ribbons on bottles (below) for launchings ranks as a war job



TO A lot of people the West means wide open spaces, cow punching, and gold mining. Mention Los Angeles and they think of oranges and motion pictures.

Such ideas are old fashioned today.

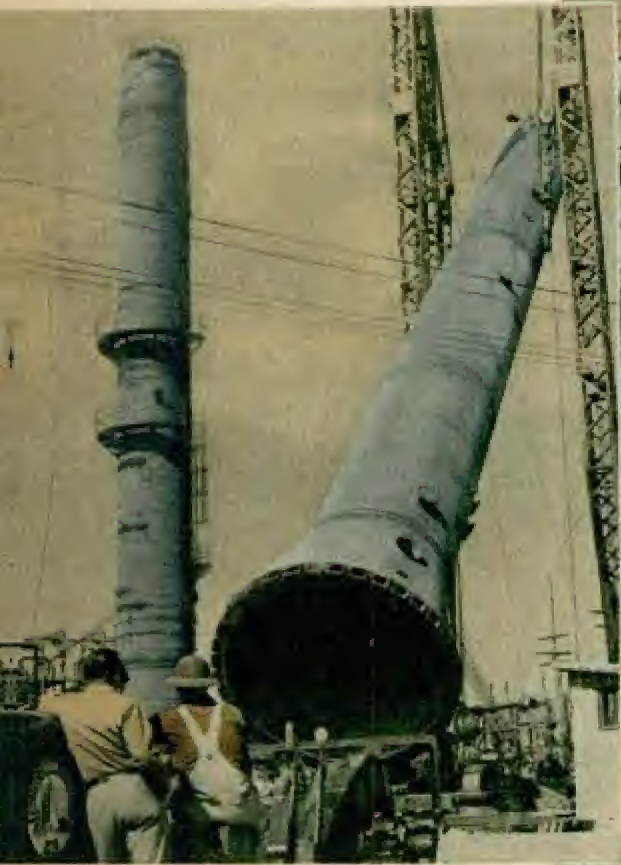
With hydro-electric power from its great dams and fuel oil from its oil fields the West is changing itself into an industrial empire.

Right now the states west of the Rockies, with not much more than 10 percent of the nation's population, are turning out a big part of our war production. Two-thirds of our heavy bombers in addition to large percentages of other aircraft are built there. About half of the nation's ships are launched on the West Coast. The West is producing a third of the country's aluminum and important percentages of our magnesium and synthetic rubber. Landing craft, tanks, guns,

Mr. Stinson: 0268

and armament of all descriptions are manufactured in the West. Los Angeles city by itself is second only to Detroit in the value of war contracts being handled.

Because of these war industries the westward surge of population has resembled another gold rush, with new arrivals estimated at about 1,000 per day. Towns that didn't exist four or five years ago are now teeming, busy communities. Men and women who had never seen an ocean are building flying boats in San Diego today. People who left their middlewestern homes a couple



Above, a styrene extraction tower at a synthetic rubber plant. Left, raising a distillation tower. Below, box kites to lift radio antennas on rafts



of weeks ago are making aluminum in Portland or are building ships in Seattle this week. Two thirds of these new arrivals, surveys indicate, will make their permanent homes on the Coast.

The war rushed western industry to the level that it was expected to reach twenty years from now. The fact is that the West was rapidly becoming industrialized before the war began. Important percentages of the country's food, lumber, petroleum, and minerals, from gold to clay, come from the western part of the United States.



Above, a power nacelle in wind tunnel of aircraft plant in Los Angeles. Right, plywood glider wings in a western glider factory. Below, assembling the "ditty bag" of a ship's life raft, which includes blankets, awning, fishing gear, signal lamps and flares, first aid kit, oils and even magazines and games, besides the necessary food and water



Los Angeles, all by itself, is industrially more important than are some small European countries. The city has been second only to Detroit in the assembly of automobiles, second only to Akron in making tires and rubber goods, and among the top three areas in petroleum refining. It leads the nation in aircraft, motion pictures, sports-wear, and oil well tools. It is the fourth largest furniture manufacturing center in the country. It ranks fifth in the nation in number of factories, number of wage earners, and value of manufactured products.

In spite of such statistics, western economy has been lopsided because the West manufactures only a small fraction of all the goods it consumes. The 11 western states normally buy about 15 percent of the goods manufactured in the country, all but



a small fraction of which is shipped west with the western buyers paying the freight. "Prices higher west of the Rockies" has been a familiar line in many national advertisements. It is estimated that if rugs, for instance, were manufactured on the Coast the average western purchaser would pay shipping charges of half a dollar per hundred pounds instead of more than two dollars per hundred pounds that it now costs to transport rugs across country. The 11 western states purchase 13 percent of the nation's radios and phonographs while producing only two percent of them. Sales of electrical and gas appliances in the West amount to 15 percent of the nation's total,



Above, Lockheed "Lightnings" come off assembly line. Manhours required to build a P-38 were halved in the last year. Below, girls make parachutes, an important industry on the war-stimulated West Coast

though only 2.6 percent are manufactured in the West. This explains in part why the West has been building up its own industry.

For a long time, too, the West has wanted to make iron and steel from local ores instead of hauling it from eastern mills at cost plus freight. Deposits of iron ores, coking coal, and limestone are scattered all through the West.

Today, at Fontana in Los Angeles county the Henry J. Kaiser Company is operating the Coast's first fully integrated steel plant, consisting of blast furnaces, open hearth furnaces, rolling mills, structural, plate, and merchant mills. Kaiser's is a \$90,000,000 project. At Geneva, Utah, an integrated steel plant costing twice that much and correspondingly larger, is just getting into production. Both plants are of the latest design, are government-financed, and are currently making ship's plate. They are "war babies" in the sense that they were built to meet the demands of war but western industry hopes to keep them busy after the war is over.

Up and down the coast the capacities of smaller mills for processing steel have been increased and in the Northwest attention is being paid to the possibility of producing electric furnace pig iron. Much of the elec-





Bridges, tunnels, and roadways provide three levels for automotive travel approaching Los Angeles

tric energy from the Bonneville-Grand Coulee power circuits in the Northwest is currently used to operate five great aluminum plants that have an annual capacity of 500,000,000 pounds of metal.

Magnesium, lighter than aluminum, is being produced in a vast plant near Las Vegas and in a Kaiser plant in California. Six big synthetic rubber plants near Los Angeles are creating rubber at the rate of 90,000 tons per year.

Being new, all the big plants in the West were designed to use modern techniques and to take advantage of the latest ideas. Thus the new synthetic rubber plants manufacture rubber almost without human aid. Automatic instrumentation in the form of a few electric control boards does most of the actual work. Measured amounts of

chemicals are poured into the right vats at the right times, temperatures are automatically maintained, mixing machinery goes to work, and the vats dump themselves when mixing is complete. A handful of men instead of several hundred keep such a plant going.

Another example of modern practice is the Permanente cement plant near San Francisco, called the world's largest. This plant practically runs itself for it generates its own electricity, free, and the electricity in turn performs most of the work. Conveyor belts traveling down a mountain are kept in motion by the weight of the cement ore that they carry, and generators that are rotated by the belts supply current that operates the digging shovels, crushes and grinds the rock, and lights the plant.

Manpower efficiency has gone hand in hand with efficiently designed plants and factories. A heavy bomber that required 37,000 manhours of labor to produce in a typical western plant in 1943 is now built in only 16,000

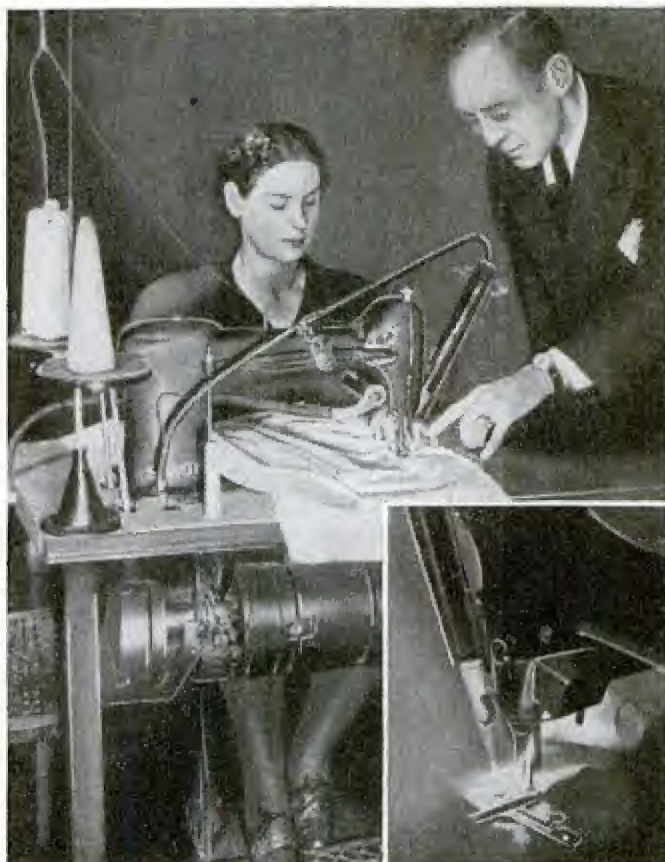


Left, molten metal is carried in pot to Basic Magnesium plant in Nevada for final processing

■ In 1943 the steel industry consumed electricity enough to supply 17,178,000 families for twelve months and fuel oil sufficient to heat 1,406,000 homes for a year—a record-breaking schedule.

OCTOBER, 1944

Beam of Light Protects the Blind On Speedy Sewing Machine



Blind workers can operate safety sewing machines with needles that move at 4,500 strokes a minute. The machines are equipped with photoelectric cells which cast a protective circle of light around the needle. When the light beam is broken the machine is brought to an instantaneous stop. Attaching the magic eye to the sewing machine was accomplished in the engineering laboratory of the American Foundation for the Blind.

Cellulose Sponge Acts as "Fire Guard" If Flak Hits Bomber's Gas Tanks

Because of the rubber shortage, cellulose sponge has been perfected as a substitute for sponge rubber, or latex foam, in keeping bomber wings as fire-proof as possible. The cellulose sponge, a handyman in millions of prewar households, is inserted in the wing spaces around the selfsealing gasoline tanks to soak up the fuel which usually escapes before the rubber swells to close the holes made by enemy bullets. If allowed to flow into open wing spaces around the tanks, the gasoline would form a highly flammable and explosive mixture with the air. So that the sponge won't absorb water, which would add unduly to the weight of the plane, the "fire guard" is treated with a water repellent. Untreated cellulose sponges are used by the armed forces in large quantities for washing and cleaning jobs.

C. J. du Pont de Nemours & Co., Inc.
Wilmington 98, Del.

TELEVISION *after* V-DAY



By **Roderick M. Grant**

THE time is tomorrow. In a certain busy factory the production manager presses a button on his desk and there flashes on the television screen before him a scene at

a strategic spot on the sub-assembly line.

He watches the moving line for a moment, then his finger touches another button: the scene shifts to reveal a giant hydraulic press pounding out great metal forms.

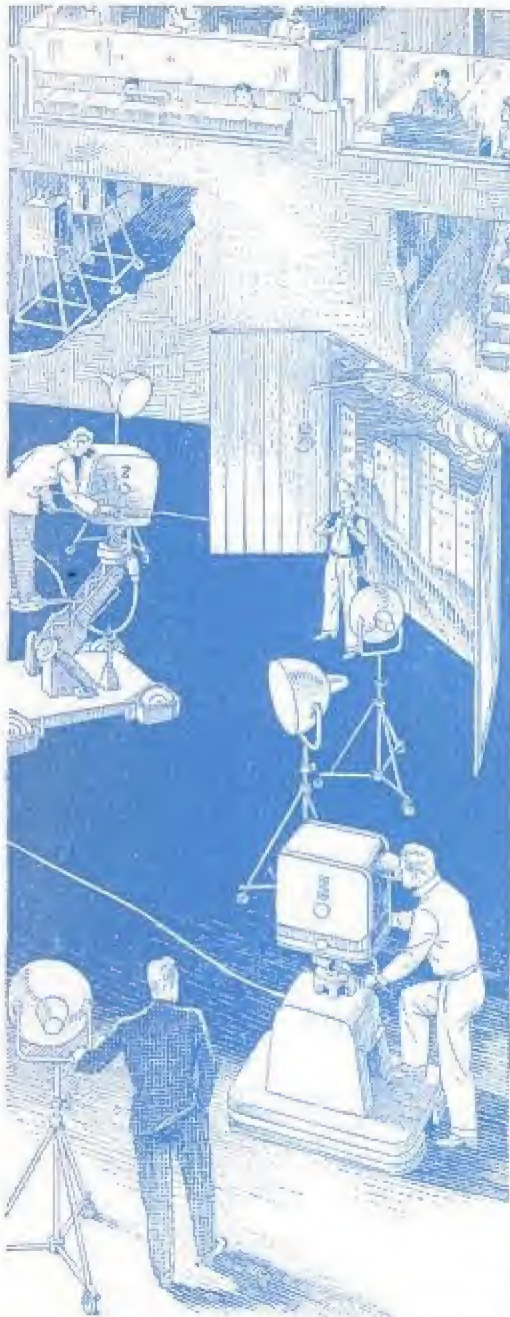
That is television at work. Television useful as well as ornamental.

Now look a bit farther into the future. On your living room wall a televised Hollywood movie plays for a roomful of guests. It is televised in full color, and you are boasting that any day now there'll be "airborne" movies in three dimensions.

One of your guests is ready to go home, and you telephone for a taxicab. In a few min-



Quality of picture is controlled at "shading desk" in television studio

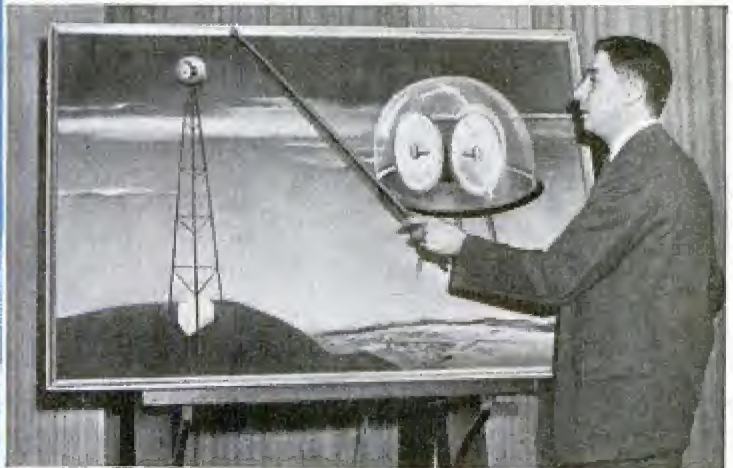


utes it arrives, summoned by shortwave radio while cruising. Before retiring you turn on your facsimile set to record the morning news while you sleep; and suddenly your FM receiver automatically comes alive with an important news flash from a master transmitting station that can call in your set without your own help. And when you are out, the magnetic wire recorder takes over as "home secretary" to record any phone calls during your absence.

OCTOBER, 1944



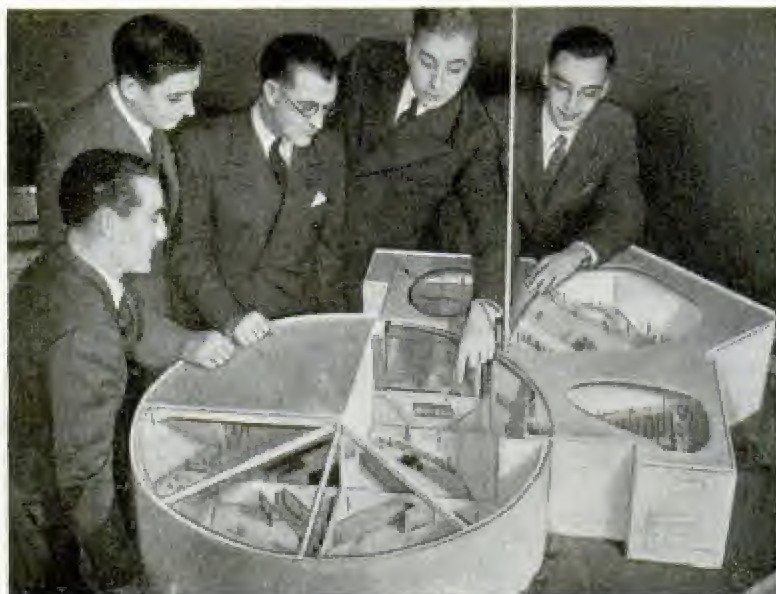
Home television screen on RCA experimental set retracts into the cabinet. Image is reflected to the 13½ by 18-inch screen



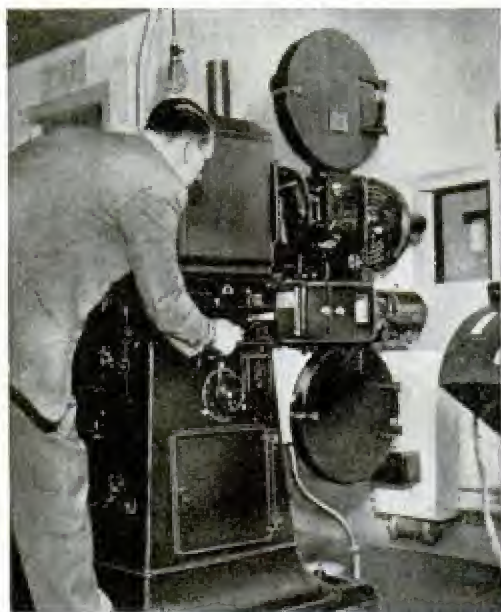
Courtesy General Electric Company

Artist's sketch of television relay station with closeup of receiver and transmitter. Below "televising" a puppet show





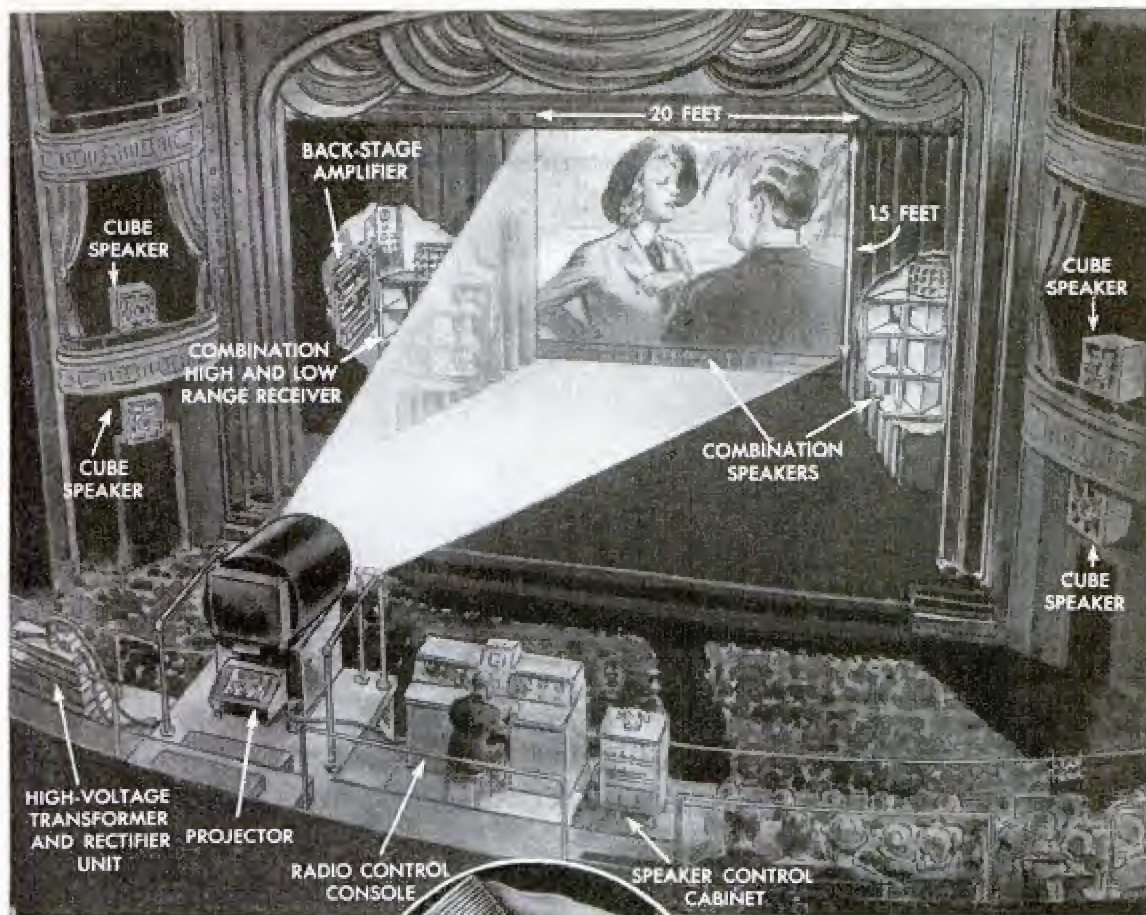
Inspecting model of postwar television building designed by the Austin Company engineers



ing, so far as you personally were concerned, to a state of suspended animation. But FM is ready for the boom. It has learned to talk in tanks and fighter planes and landing boats; it is the voice of the walkie-talkie on the Normandy beachhead. It is also the voice of television. It has the multiple advantage of static-free, high-fidelity reproduction through the full range audible to the human ear; high-frequency transmission on a band sufficient to provide channels for upward of 3,000 American FM stations without interference, contrasted with the 912 AM stations occupying only 106 channels today; and FM operates at lower power cost. With amplitude modulation the broadcast signal must be 100 times as strong as any interfering noise on the same wave; with FM, only twice as strong. Translated into

A very beautiful dream. And some of it is not so far from realization. After the new rules of peace are posted on the remains of the mikado's palace you will go shopping for an alarm clock, an automobile with 100,000-mile tires, and a radio-television set that does everything but read your mind. You'll hunt through the second-hand stores for an army walkie-talkie to take along on that fishing trip, and you'll learn that your doctor already carries one to keep





transmitting power requirements, this means that, with respect to elimination of interference, a 200-watt FM station is equal to a 500,000-watt AM station on the same channel.

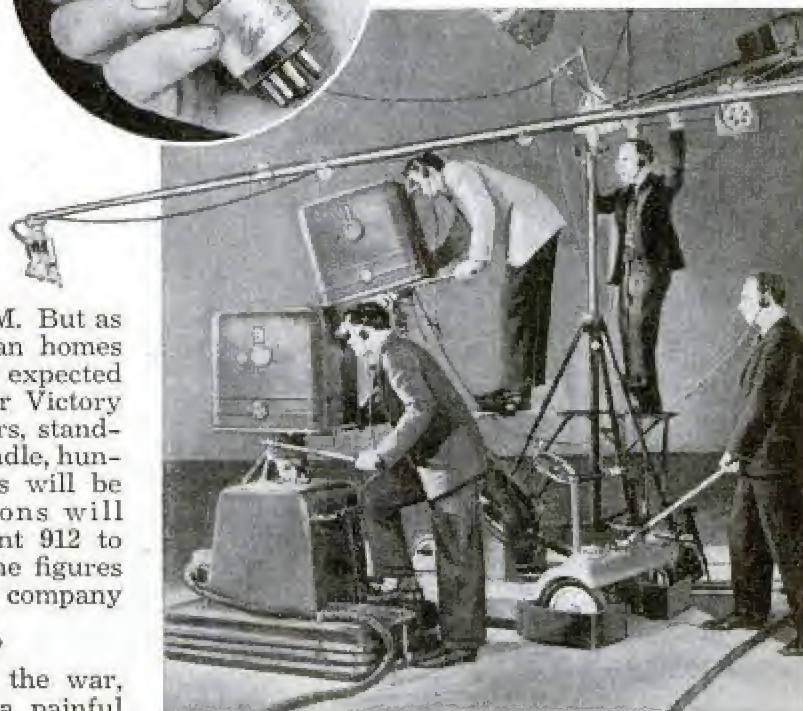
This all adds up to the confident assertion by the industry that you will be switching from AM to FM after the war. For a time, radio stations probably will broadcast the same programs on both AM and FM. But as FM receivers in American homes (now 600,000) swell to an expected 5,000,000 in the year after Victory and 15,000,000 in five years, standard broadcasting will dwindle, hundreds of FM transmitters will be operating and AM stations will shrink from the present 912 to around 750. Those are the figures of a General Electric company executive.

And what of television?

Its growth stunted by the war, television is enduring a painful



Sketch shows setup for the projection of television in a theater. The tube (left) makes ultra-high frequency relaying possible. Below, using television cameras in studio





Television transmitter — its range is only to the horizon

adolescence. What's ready, if Victory Day were tomorrow, is the promising if primitive marvel that went on the air to the New York, Schenectady and Hollywood neighborhoods five years ago: airborne talking pictures mirrored to you from a 12-inch cathode ray tube, at times flickering and lightstruck and distorted like a 1910 nickel show. What's ahead is—super.

Television engineers promise you that true color television can be produced 10 years after you relieve them of the burden of war research. A mechanical method of televising color with whirling disks synchronized to a related mechanism in the home receiver has been tried; but electronic color is what the broadcasters order, and it will come.

Experimentally, RCA has projected television on a 15 by 20 foot theater screen. RCA laboratories have built experimentally sets with an 18 by 24-inch translucent television screen for home use, the picture being mirrored to the back of the vertical screen from the cathode

ray bulb. There is also an experimental projector using a 6 by 6-foot screen. The American appetite wants nothing less than today's ball game thrown on the playroom screen as large as life and as noisy. Give them a few years and the magicians of RCA and General Electric and DuMont and the rest will produce a television projector matching today's movies in clarity on a six-foot home screen or a 15 by 20 foot theater screen. In fact RCA is confident that theater television is "practically ready for commercialization immediately after the war."

One of the more painful symptoms of television's growing up is the dispute over postwar standards. The Columbia Broadcasting System brought the issue into sharp focus by calling for a moratorium in the manufacture of television receivers of pre-war type for a year or more after the war, until the industry can develop higher-frequency equipment capable of producing more brilliant, detailed pictures. This would mean the eventual



Six-foot home screen for television is a postwar prediction. Below, an early NBC television studio showing camera men working under banks of hot lamps



scrapping of the 7,000 television receivers now privately owned and the \$20,000,000 investment of the broadcasters; but Columbia argues that it would protect the public from further investment in a low-standard television system that would soon be obsolete.

CBS backed its declaration of policy with an order for an experimental transmitter which would operate on frequencies above 400 megacycles, compared with the present CBS television station's 60-66 megacycles. The standard 441-line television image adopted in 1938 contains some 250,000 tiny picture elements, comparable to the dots of a newspaper engraving. The proposed 40-mc picture would contain up to 585,000 elements; the anticipated result, larger and clearer images.

Secrecy surrounds the discoveries of wartime electronic research, but CBS asserts: "Enough has already been done—developed, tested, proved and put to work—to strike off the technical shackles that held pre-war television to a relatively coarse-screen picture. Enough to free television from the straightjacket of narrow-band, black-and-white transmission. Enough to promise pictures twice as large and twice as rich in detail, as well as pictures in full and brilliant color. Enough, in sum, to make the 'good-enough' pictures of pre-war vintage seem not good enough at all, in terms of post-war possibilities."

On the other side of the question, the National Broadcasting Company advocates continued use of prewar standards after the war while research goes on. Niles Trammell, president of NBC, has said: "Television should not be held from the American public while experimenters deal in theory and supposition."

The Radio Technical Planning Board, representing the industry, is studying the problem and its recommendation will be considered by the Federal Communications Commission in deciding whether the folks in Tallahassee, Topeka and Tucson will see television soon after the war, or not until television betters itself.

Many tough technical problems remain. Many are being solved in wartime research. General Elec-

Giant "Bombs" to Protect Radio Are Molded Plastic Domes



Three different-shaped plastic domes which, when stacked one on top of the other, resemble a block buster bomb, are used to protect wartime radio equipment built by General Electric. The largest of the three domes, painted black, measures 35 inches in diameter and 43 inches in height and is one of the largest single pieces of plastics molded by General Electric at its Pittsfield, Mass., plant.

tric has introduced a tube not much bigger than your thumb, generating frequencies beyond 1,000 megacycles; it may be the heart of nation-wide television networks. The early difficulties of providing highly intense studio lights by which the Iconoscope can pick up nearly 6,000,000 picture elements per second are being eased; actors who once perspired and wilted under the heat of multiple banks of lamps now perform coolly under water-cooled mercury lamps. RCA has a new supersensitive tube that "sees what the eye sees."

Continued to page 148

Plastic "Ghosts" of Women Pilots Studied by Plane Designers



Life-size manikins made of plastics are used by the Air Forces to enable designers to adjust plane interiors and equipment to the comfort of women Air Force service pilots. The "ghosts" were sculptured to the composite dimensions of three average WASP types—large, medium and small—after 35 measurements had been taken of each WASP. The manikins are made in sections and the mechanical action of each human joint is reproduced by means of elastic "tendons," making possible more natural studies of operating space requirements. While they are seated or standing in the plane, the manikins' transparency gives the designers a clear view of points of contact.

Seven Tasks for Scientists Listed by Research Man

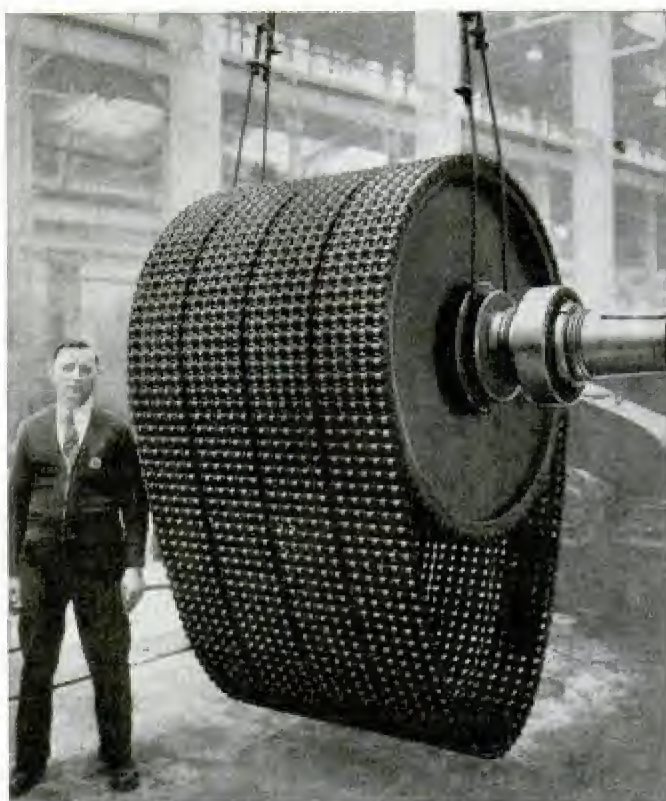
Seven unsolved problems awaiting the answer of future research men were listed recently by a Westinghouse engineer. They are:

1—How to make electric lamps of

a sixth of the possible efficiency (100 lumens per watt). 2—How to get two colors from the same electrical discharge in a gas or vapor. 3—How to combine fluorescence with phosphorescence and prolong the rate of decay of the latter. 4—How to conserve fuel by placing radiant heat directly onto the body rather than heating the air. 5—How to develop indoor sunshine for a vegetable garden in the basement. 6—How to develop walls and ceilings as glowing light sources. 7—How to use visible light as a glorifying medium, sometimes described as "mood conditioning," rather than the elementary job of utilitarian seeing.

Tug's Big Propeller Drive Includes 10,000 Parts

More than 10,000 parts went into the enormous marine propeller drive used on the Navy's new 110-foot harbor tugs. The largest roller chain application of its kind, it couples two direct-reversing Diesel engines of 635 horsepower each to a single propeller with 3 to 1 reduction and provides outstanding advantages in efficiency, economy and flexibility.



The enormous propeller drive dwarfs man standing next to it

POPULAR MECHANICS

Morse Chain Co.

Ithaca, N. Y.

Westinghouse Electric & Manufacturing Co.

C. S. du Pont de Nemours & Co., Inc.
Washington, D.C.

Dr. S. G. Webber, Director
of Applied Lighting, Westing-
house Electric & Mfg. Co.
Pittsburgh, Pa.



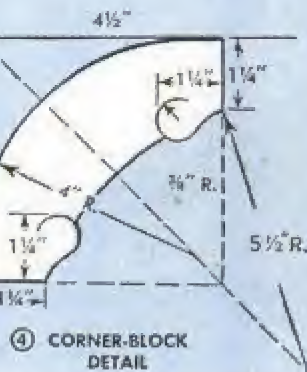
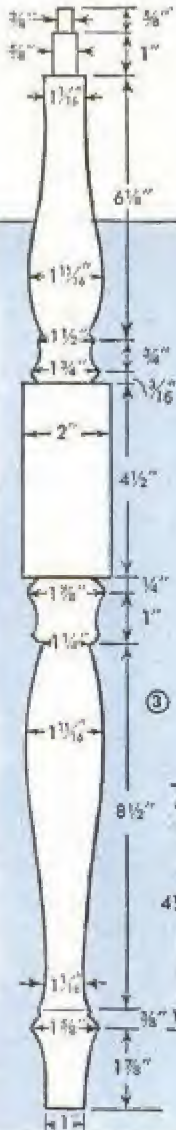
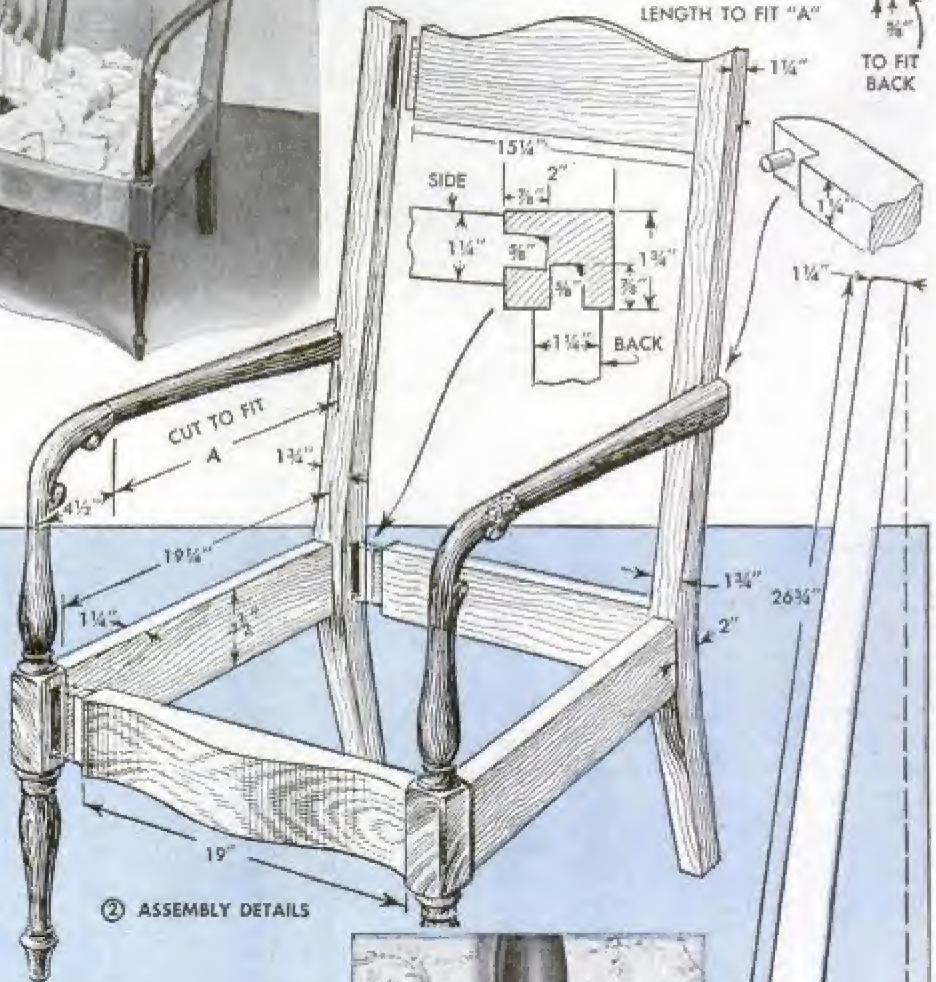
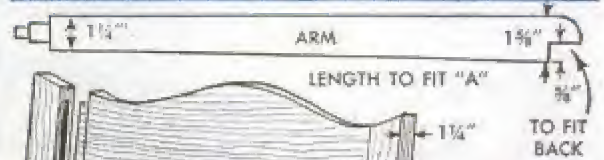
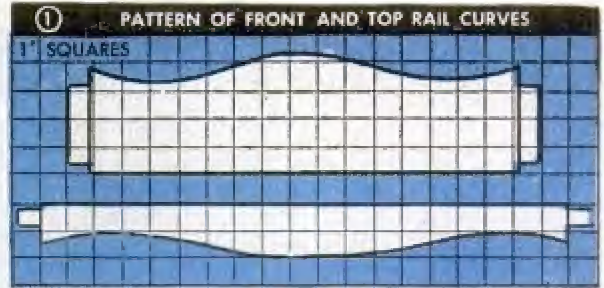
Sturdy **PULL-UP CHAIR** *has graceful lines*

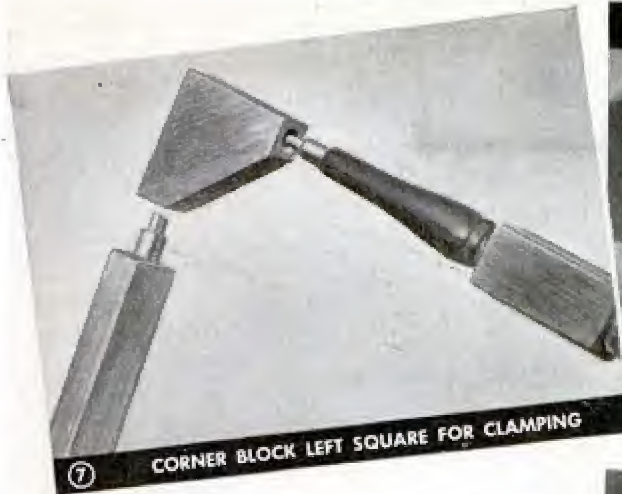
By Benjamin Nielsen

WITH its sturdy double-tenoned and doweled construction, this pull-up chair is not only designed to give long service, but it also has simple, graceful lines that are becoming to any living room. Walnut always is a good choice of wood for a chair of this type, but any other hardwood will do equally well as all of the frame is covered except the legs and arms, which should, of course, be made of a tough hardwood that has an attractive grain.

The rear legs and back support, Fig. 6, are sawed from 1 $\frac{3}{4}$ -in. stock 5 in. wide, and mortised for the top and bottom rail tenons as shown in Fig. 2. Top and front rails are band-sawed according to the pattern in Fig. 1, each having tenons $\frac{5}{8}$ in. thick and $\frac{7}{8}$ in. wide at the ends. For the top rail, use a piece 1 $\frac{1}{4}$ in. thick. Because of the bulge in the center of the front rail, a piece of 2-in. stock is required for it. Since the back rail is 3 $\frac{3}{4}$ in. shorter than the front to allow for the outward spread of the chair, the side rails should be beveled at one end as shown in the detail of Fig. 2, to fit snugly against the back support and conform to the spread. All mortise-and-tenon joints in the legs are reinforced with dowels as indicated in Fig. 9 to assure unusually rigid construction. The dowel holes are drilled from the inside surfaces of the legs, and can be drilled



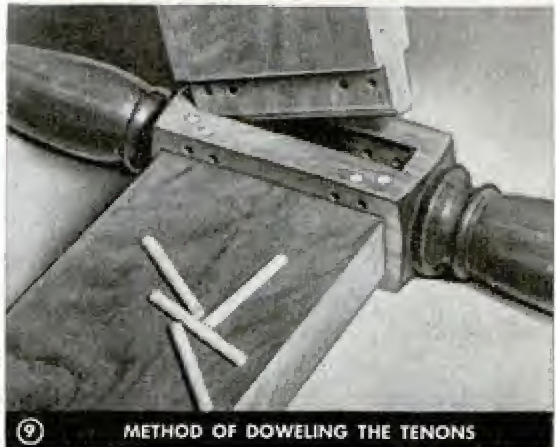
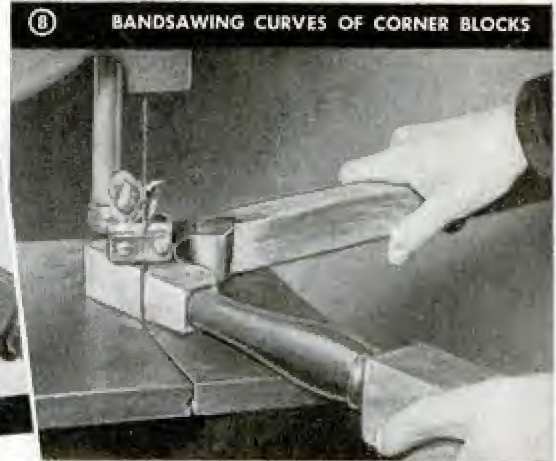




clear through the front legs as they are covered with veneer at these points. However, if veneer is not used, the holes should be stopped before the drill breaks through the outer surfaces, otherwise the dowel ends will show in the finished chair. Also, the dowel holes in the rear legs must be stopped, as the legs are not covered at these points. Front legs are turned to the dimensions given in Fig. 3. Note that the tenon at the upper end which fits into the hand rest is stepped to reduce the diameter so that it may be extended farther into the hand rest, Fig. 4, than would be possible otherwise. If the tenon were turned to the same diameter for its entire length, its end likely would be exposed when the hand rest was shaped to size. Therefore, to provide sufficient diameter to resist breakage of the tenon under strain and to allow the tenon to be inserted into the rest far enough to afford a good glued joint, it is turned to two diameters.

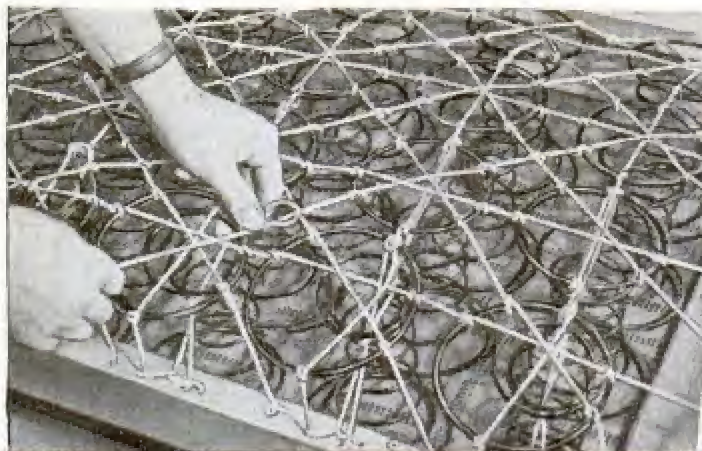
The front legs are mortised for the side-rail tenons and burl veneer is applied to front and sides as shown in Fig. 5. Arm rests are cut to fit. These also are step-tenoned at the front ends and taper slightly from front to back as illustrated in the upper detail of Fig. 2. They are notched at the rear ends to fit over the back support to which they are doweled and glued, using dowels as large as possible without the dowel hole weakening the arm.

Fig. 4 shows the construction of the corner block from which the curved hand rest is cut. The shape of the upper curve is found by locating a common point 4 in. from diagonal corners of a $4\frac{1}{2}$ -in.-square piece of wood. Measure off $1\frac{1}{4}$ in. from these corners and from these points locate a common center of $5\frac{1}{2}$ in. radius from which to scribe the inner curve. If you wish to carve the sides as indicated, the design should be marked off now, after which the block is sawed to the shape

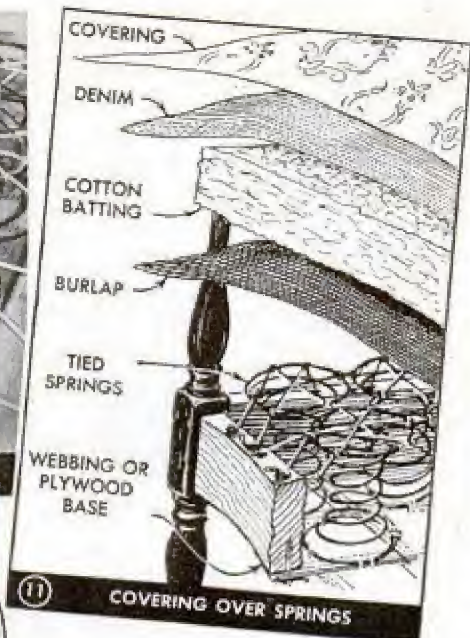


shown in Fig. 7 to facilitate clamping the pieces tightly when they are glued. Following this, holes are drilled for the tenons. Then the legs and arms are glued in place in the corner block and, when thoroughly dry, the curves are band-sawed, Fig. 8, after which the design may be carved on the sides and the corners rounded by sanding. Do this carefully to avoid ruining the piece and thus waste a lot of meticulous work already done. Assemble the members with glue and clamp all corners tightly until dry. Apply a filler and rub it into the grain thoroughly, after which the frame is varnished.

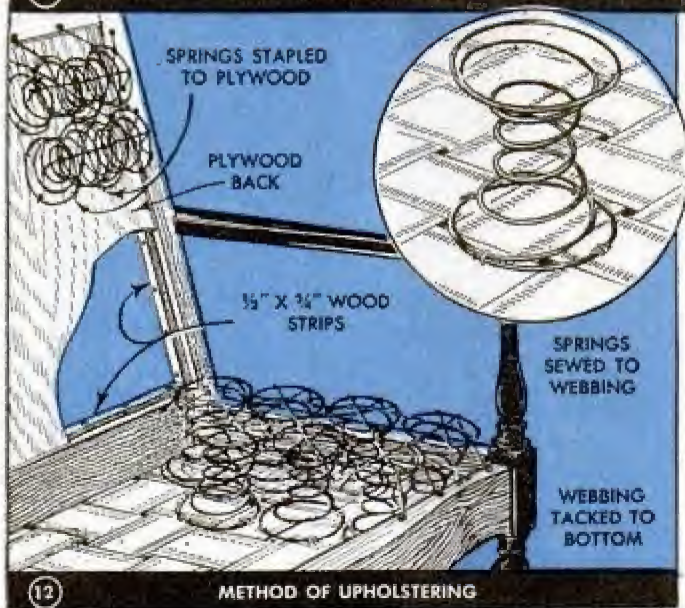
After completing the framework, you are ready for the upholstering job. If suitable springs are not at hand for the seat, you may be able to use some of the pocket type taken from an old automobile cushion. These should be sewed into pockets of new material, preferably muslin, and installed as shown in the illustration opposite Fig. 1. If coil springs are available, webbing may be used to support them in the seat frame, or plywood nailed to the lower edges of the side rails as suggested in Fig. 11. If webbing is used, the springs should be sewed tightly to the strips as shown in the circular detail of Fig. 12. Upholsterers' cord is



10 HOW SPRINGS ARE TIED



11 COVERING OVER SPRINGS



12 METHOD OF UPHOLSTERING

tied to each spring to brace it in all directions, and nailed to the side-rail edges as in Fig. 10. If the cords are not pulled tight before tying, the springs will tend to loosen and cause bulges and depressions in the covering to spoil the appearance of your work. For the back, a sheet of $\frac{1}{4}$ -in. ply-

wood, supported by and bradded to wood strips or narrow molding, will give firmer support to the occupant's back than the more resilient webbing. The springs are attached by staples driven into the wood and clinched on the back.

To upholster the seat and back, cover the springs with a layer of heavy burlap pulled down tightly and tacked to the side rails. Place over the burlap a generous padding of cotton batting. Curled hair or kapok is, of course, superior to cotton but may not be available.

Over the padding, denim or some equally strong fabric is laid and nailed smoothly in place, and finally the tapestry cover is tacked in place. Gimp may be fastened by upholsterers' tacks around the lower edge of the seat, along the edges of the legs and around the back to give a finished appearance to the job.

Band-Saw Table Pin Removed With a Claw Hammer



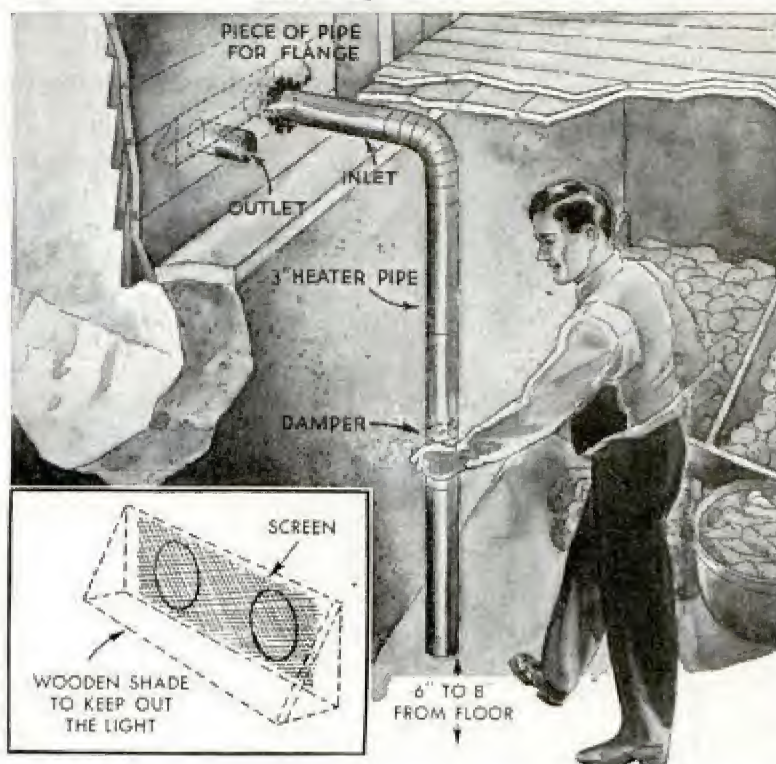
The next time you change band-saw blades, try the simple claw hammer-and-block method of removing the table pin. As shown in the photo, the pin can be pulled straight out. This method eliminates ugly scratch marks which invariably result when pliers are used.

Spectacle Case Holds Tokens

You can keep ration tokens conveniently in a discarded spectacle case. Such a holder is large enough for all the tokens of the average family, and it is flat enough to be kept easily with the ration books.

Winter Air Refrigerates Vegetable Storage Room

Safe storage of vegetables in a basement requires that the storage room be kept as cool as possible, and that proper ventilation and humidity be maintained. To approximate this condition in the average home, the owner can bring cool air in from the outside by means of a 3-in. sheet-metal heater pipe as shown. The pipe should extend down to within 6 to 8 in. of the floor, and a short outlet pipe should be provided as indicated to permit air circulation. A damper in the inlet pipe permits regulation of the incoming air to prevent freezing inside the storage room during extremely cold weather. As the storage room should be dark inside, a shade is fitted over the ends of the pipes where they pass through the outside wall. This is merely a triangular box having the underside open. Screen wire over the ends of the pipes keeps out insects. Of course, the storage room should be tight to

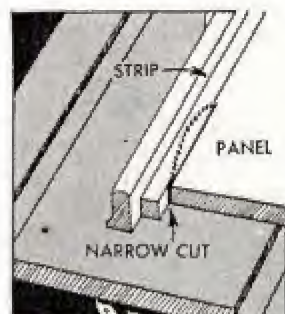


keep cold air from entering the rest of the basement. If possible, the room should be insulated. This can be done inexpensively by lining it with $\frac{1}{2}$ -in. insulating board, which is available at your lumber yard.

Glass Lining Inside Grinder Cup Prevents Rusty Water

Water poured directly into the grinder water cup quickly becomes rusty and dirty because the water attacks the metal. Clean water and easy changing are provided by fitting the cup with a glass jar or tumbler.

Slender Cut Made on Circular Saw With Aid of Wood Strip

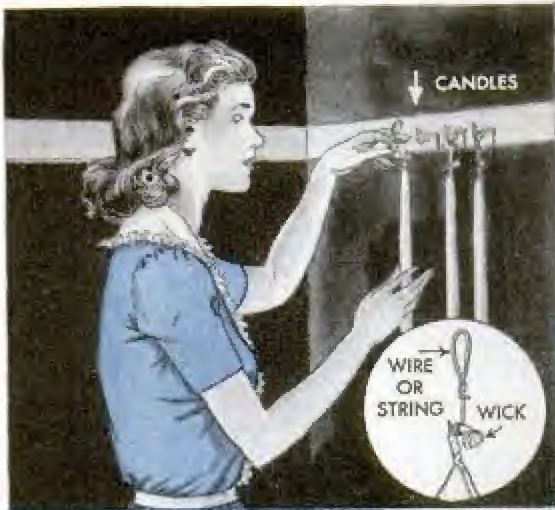


Lacking the use of a jointer, or when the fence on the power saw is not equipped with a wooden side, a saw cut equal to, or less than, the thickness of the saw blade can be shaved off a panel with the help of a

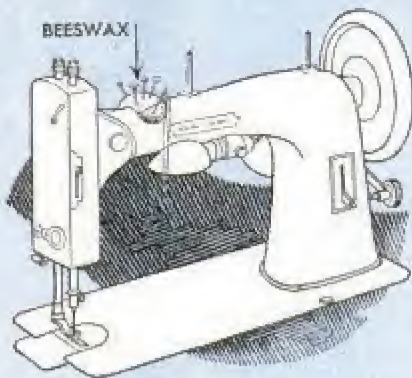
1-in. strip of wood. The fence is set 1 in., plus the thickness of the ripping desired, away from the outer teeth of the saw, after which the strip and the panel are worked through the saw simultaneously.



Solving HOME



Instead of storing long candles in a drawer when not in use, suspend them by their wicks. This keeps them straight and prevents accidental breakage

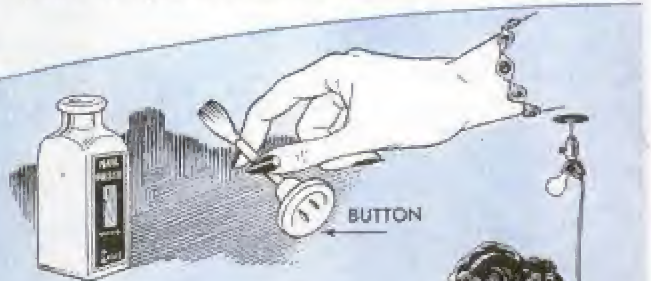


You can keep pins and needles conveniently at hand at your sewing machine if they are pushed into a piece of beeswax stuck to the machine

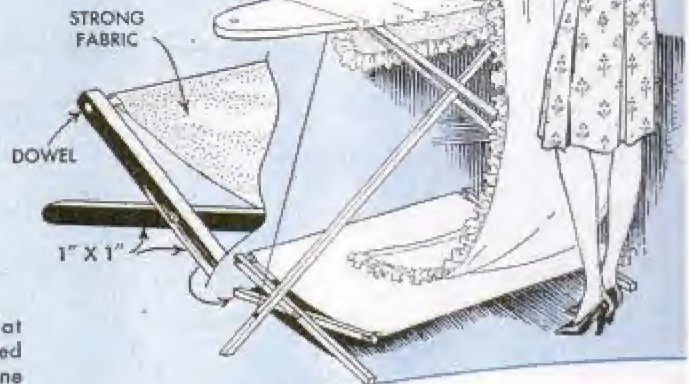


When the refrigerator is crowded, carrots will keep fresh and crisp outside of it, if placed in glass jars. Wash the carrots and, while still wet, place them in jars, screwing the lids tightly to retain moisture

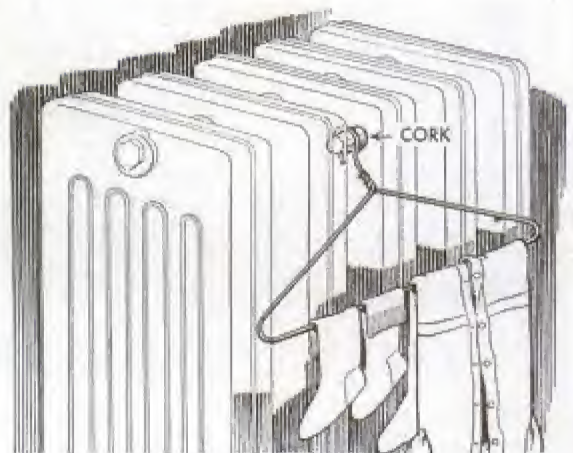
Cement a large button to the stopper end of your nail-polish brush and you can stand it on end when you want to set it down. This prevents getting polish on the vanity and makes the brush easy to pick up



When ironing long articles, such as curtains, use of a holder like the one below will keep them from touching the floor. It folds for storage and consists of X-shaped end pieces joined by dowels and covered with cloth

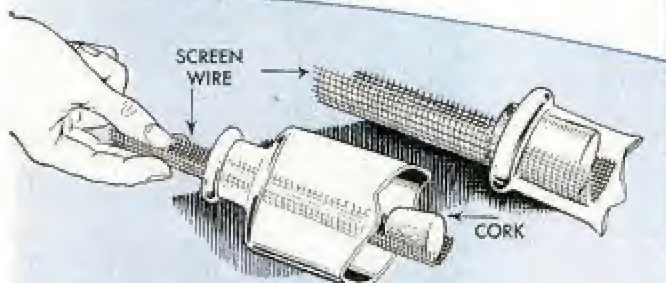


Supporting small laundered pieces near a radiator to dry them is no problem if a coat hanger is hooked over a cork wedged between two radiator sections

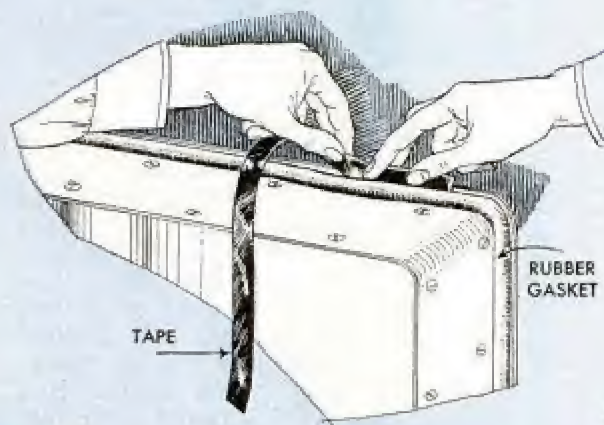


PROBLEMS

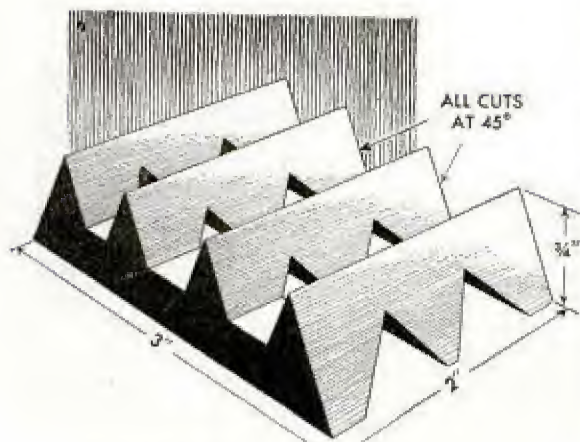
To remove a cork that has been pushed inside a bottle bend a narrow piece of screen wire to a trough shape and insert it into the bottle under the cork, which then can be pulled through the bottle neck



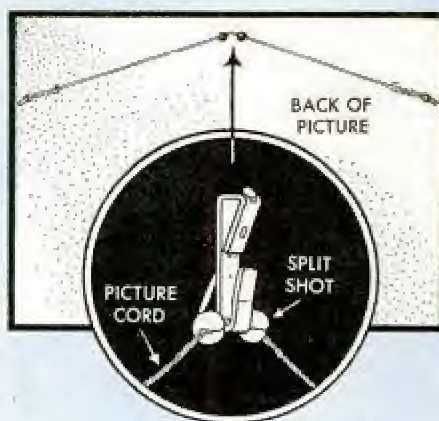
Depressed spots in the gasket of a refrigerator door that permit air leaks often can be repaired simply by placing strips of adhesive tape behind the spots to bring them out flush with the edge of the gasket



With this frame in a soap dish, soap dries more quickly and less is wasted. The frame is made of $\frac{3}{4}$ -in. stock, the V-cuts being formed on a circular saw



If a hose is unavailable for wetting ashes to keep down dust while removing them from a furnace, a garden sprayer of the tank type will do

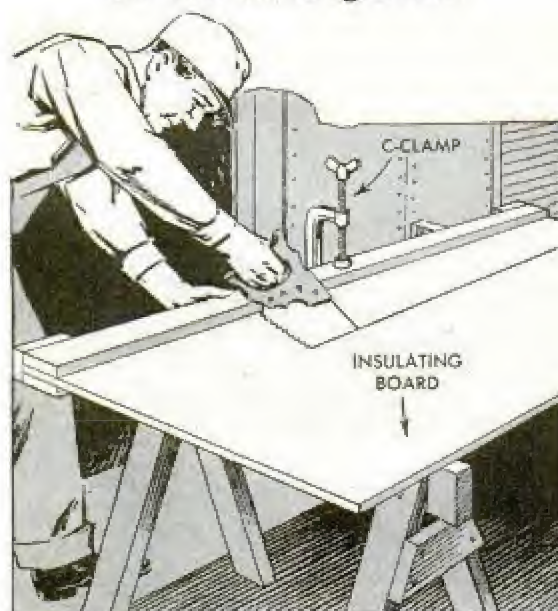


Wall pictures will not slip and hang at a slant if a lead-shot fishline sinker is pressed over the picture wire at each side of the hook that holds it



To clean the top edges of books, which will become soiled in spite of regular dusting, spread the covers apart, grip the pages tightly and rub with fine steel wool. Or, a sponge eraser can be used similarly

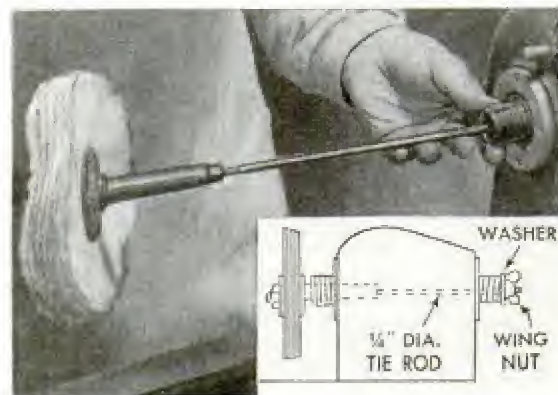
Fixture Stiffens Insulating Board To Saw It Lengthwise



Difficulty often experienced in sawing long panels of insulating board because of its flexibility can be overcome by using a fixture to stiffen the panel. The fixture consists of a couple of wood strips, which are spaced to slip over the edge of the panel and then cleated together in this position. In use, the fixture is merely slipped over the edge of the panel to be sawed as shown, using a C-clamp at the center to hold the fixture in place.

Taper-Shank Lathe Attachments Held Securely by Tie Rod

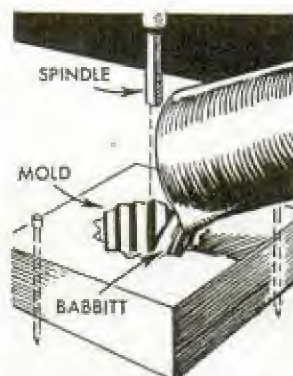
Unless held in by end pressure, taper-shank fittings used in a lathe may work loose. This annoyance can be prevented by using a $\frac{1}{4}$ -in. tie rod of sufficient length to pass through the lathe spindle. Most shanks are already tapped with a $\frac{1}{4}$ -20 hole for this purpose, but if not, it is a simple matter to drill a hole and then tap it to take the tie rod. A positive mounting of



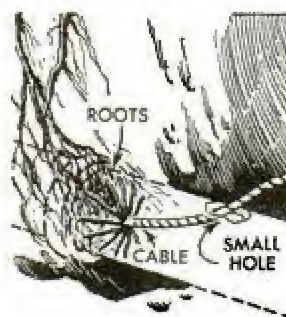
this kind always should be used when working buffing wheels, grinding wheels or drum sanders at high speed.

Replacement Knobs Cast Easily From Babbitt Metal

If you break a corrugated knob of glass, plastic or metal on some machine or instrument and a new one is unavailable, one can be cast from babbitt metal. Just bore a hole of suitable size in a hardwood block, and then make the corrugations with a three-cornered file. Set the mold on a board, which then serves as a bottom for the mold, and pour in the molten babbitt metal, first inserting the spindle or arm from which the knob was broken.—O. W. Nolen, Odem, Tex.



Plumber's "Snake" From a Cable



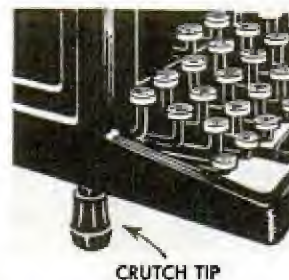
When a sewer drain becomes clogged and there is no suitable tool at hand for cleaning it, you can make one from a length of $\frac{1}{2}$ -in. wire cable. Just fray one end of the cable as indicated.

It was found that the wires were flexible enough to be pushed through a small hole made in the sewer pipe near the obstruction, yet stiff enough to clear a stoppage of hairlike tree roots.—Kendrick Martin, Oakland, Calif.

Cane Tips as Typewriter Feet

Rubber cane tips provide good replacements for worn or lost typewriter feet that are no longer available. The tips are cut down to about half their original length and then slipped over the legs of the machine. If the typewriter does not stand level, adjust the legs or place small washers inside the tips.

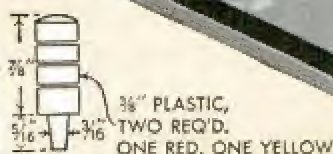
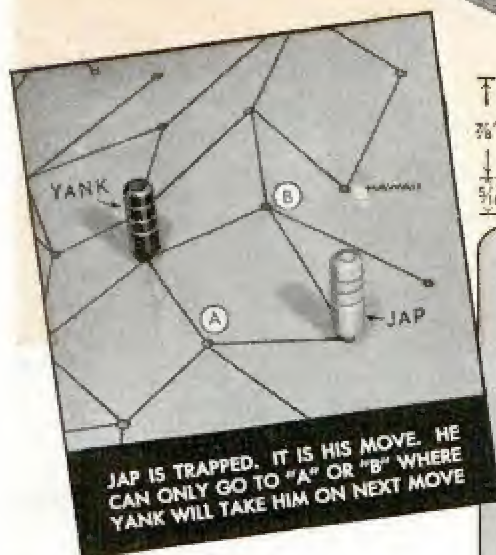
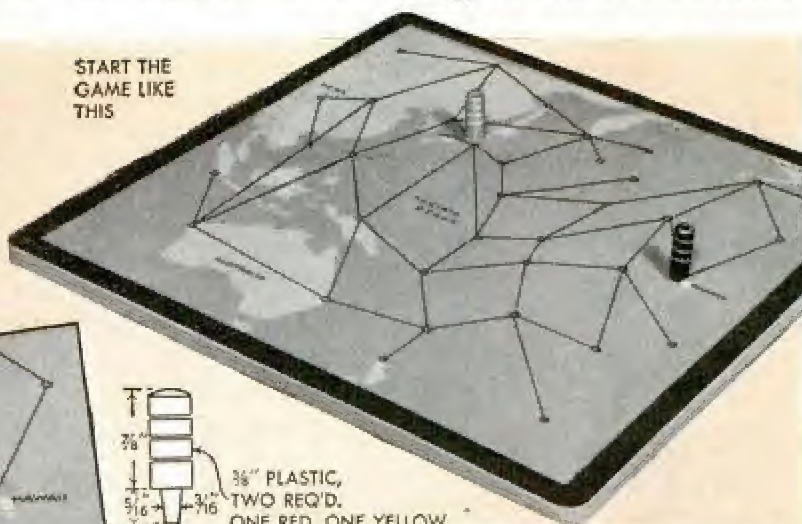
—W. H. McClay, Pasadena, Calif.



"Battle Wagons" Is an Interesting Puzzle Game

Two players, each using a peg representing the fleet, move from hole to hole toward each other with the object of "making contact." If none is made in twenty moves, the game is a draw

START THE GAME LIKE THIS



1" SQS. STOCK— $\frac{3}{8}$ " X 12" PLYWOOD HOLES— $\frac{3}{16}$ " DIA.

Played on an attractive board painted green, yellow, red and black to indicate ocean, land and travel lanes, this miniature warfare game is exciting and not too easy, since you have to win in twenty moves or less or the game ends in a draw. To try it out, you can play directly on this page, using pins for pegs. To begin, the Yank is placed at Hawaii and the other at Japan, and each moves by turn along the lines toward the other. For instance, you can go directly to the China area—which will take nine moves—and then straight for the Jap. The object is to outmaneuver and capture him as quickly as possible either by moving up behind him or by closing in directly opposite him so that you can strike his position in the next move, in which case you win. Your opponent can win in the same manner. However, if neither player wins in twenty moves, the game ends as a draw. Poor generalship on your part will permit your opponent to elude you indefinitely, and in the same manner it may be necessary for you to elude him. The playing board is made of plywood, hard-pressed board or heavy cardboard. Paint or draw the map on paper

with India ink, glue it to the board and then coat the surface of the paper with shellac to avoid soiling. Holes are drilled after the paper has been shellacked. If you find a readymade map of suitable size, you can use this instead of making one.

Lard Dissolves Tar Spots on Cloth

To remove tar spots from clothing, I merely place a lump of clean white lard over the spot and allow it to stand for several hours. After the garment has been washed in warm sudsy water, the tar spot will disappear. If traces of the lard remain, I remove them with carbon tetrachloride.

—Charles Swope, Danville, Pa.

Heat Guard on Barbecue Fork Protects Your Hands

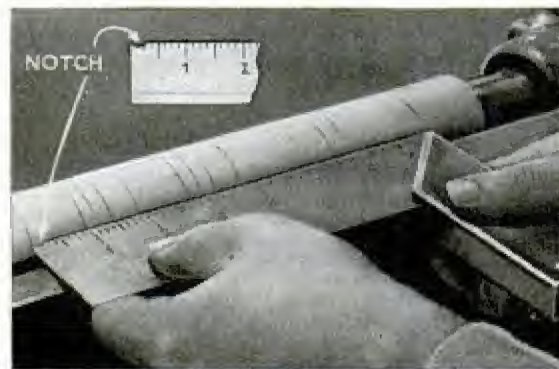


Heat often not only reddens the hands, but sometimes actually burns them when using a barbecue fork over an open fire. This trouble can be avoided by fitting the fork with a shield near the handle. The shield is nothing more than a wooden bowl drilled in the center to slip tightly over the handle. The bowl can be purchased or turned on a lathe, and if you do not mind the appearance, just an ordinary turned wooden disk will serve the purpose.

—Kendrick Martin, Oakland, Calif.

Hook Ground on End of Square Marks Spindle for Turning

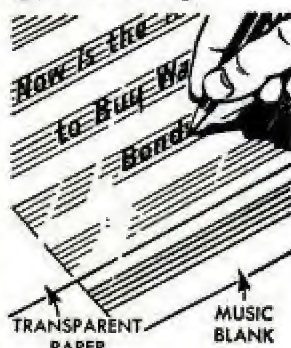
Instead of using the usual pencil-and-ruler method of laying off lathe spindle work, try this simple marking gauge. It is made from an ordinary try square, and requires only the grinding of a point at the



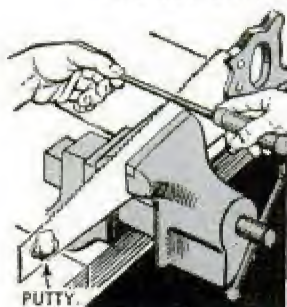
extreme end as shown. In setting off a 1-in. space on the spindle, for example, the gauge is held with the 1-in. mark over the starting line. A slight twist of the gauge enters the hook point into the spindle. Setting-off in this manner is quick and accurate, and can be used for any location point except the centerline on beads.

Music Blank Serves as Guide In Lettering Drawings

When writing on unruled, lightweight paper, or when lettering on transparent drafting paper, blank music sheets prove useful as a guide to better lettering and writing. The blanks are slipped under the paper and provide readymade lines. In drafting, the music blank can be moved where needed and helps to make all lettering of uniform size.—Michael Ligocki, Gary, Ind.



Putty Prevents Annoying Squeaks When Filing Handsaw

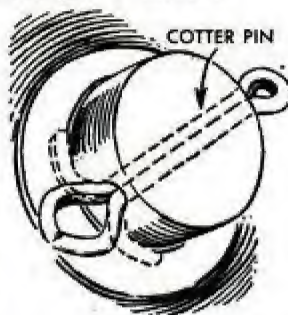


To muffle the squeaking noises that come from a saw when it is being filed, just stick a wad of putty or modeling clay to the outer end of the saw. This reduces the vibrations that are set up in the saw

blade by the file and so prevents squeaks.

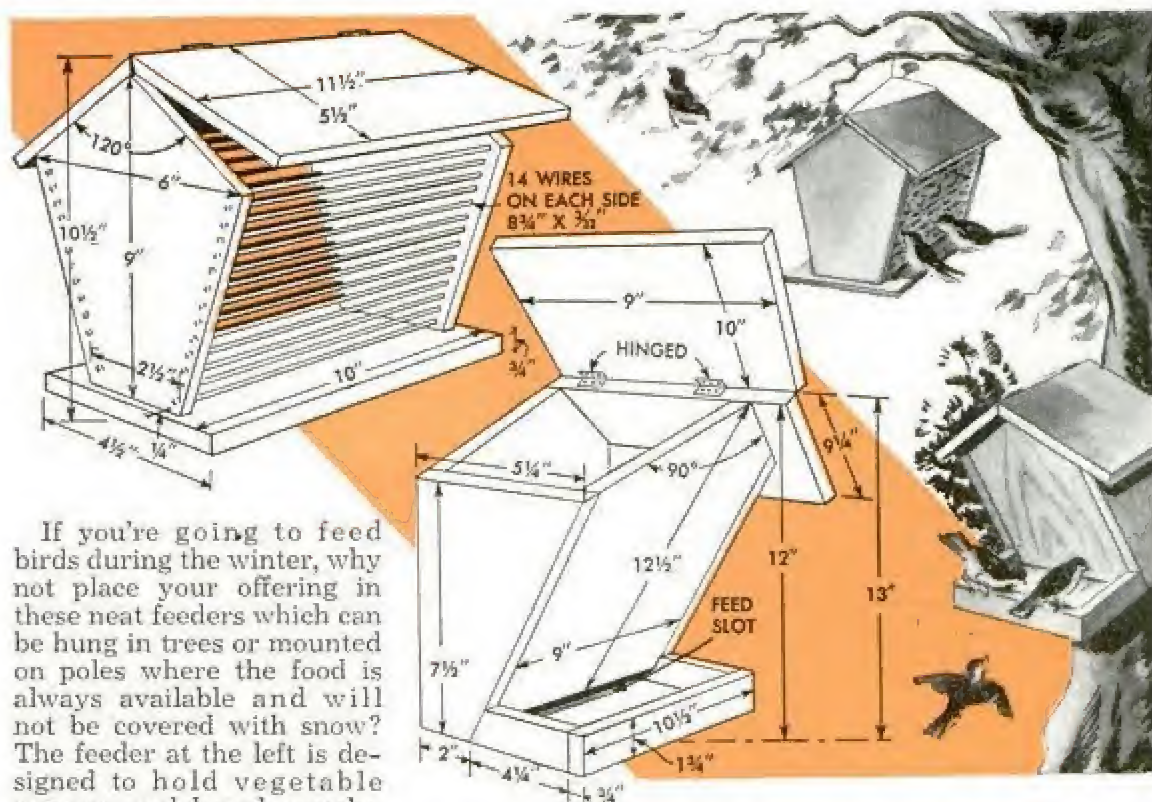
How to Lock Cotter Keys Safely In Baby-Carriage Wheels

Many of the wheels on victory baby carriages are held on by cotter keys which, if locked in the usual manner, will snag ladies' stockings and catch on furniture. However, all of this damage can be avoided if the keys are cut off and the legs bent as shown.



—C. Lundy, Floral Park, N. Y.

Bird Feeders Hold Grain or Vegetable Scraps



If you're going to feed birds during the winter, why not place your offering in these neat feeders which can be hung in trees or mounted on poles where the food is always available and will not be covered with snow? The feeder at the left is designed to hold vegetable scraps and bread crumbs, and the one on the right is for grain. The roof of the vegetable feeder is mitered at the peak, but on the grain feeder one side overlaps the other for hinging and therefore must be slightly wider. As only one side need open for filling the hopper, the other is nailed or screwed in place per-

manently. Although either type of feeder may be mounted on a post, the vegetable feeder can be hung from the branches of a tree by hooking a wire through the gable ends, allowing birds to feed from both sides at once.

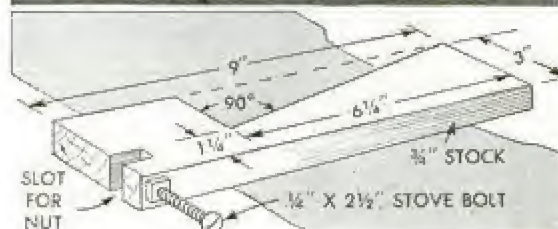
—James J. Frys, Chagrin Falls, O.

Short Wedges Cut on Circular Saw With Aid of Simple Jig

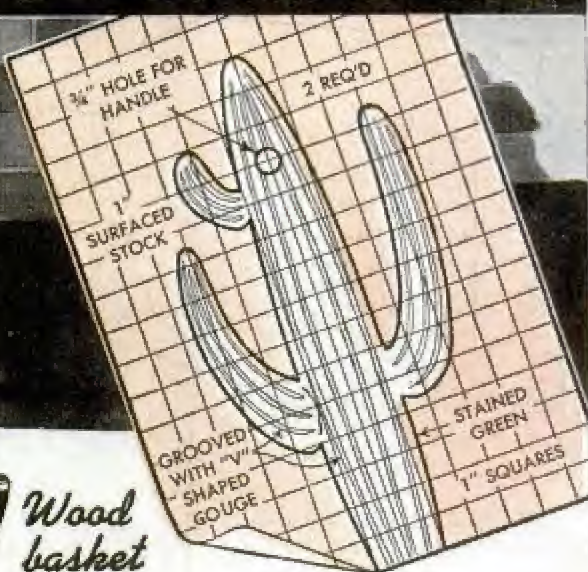
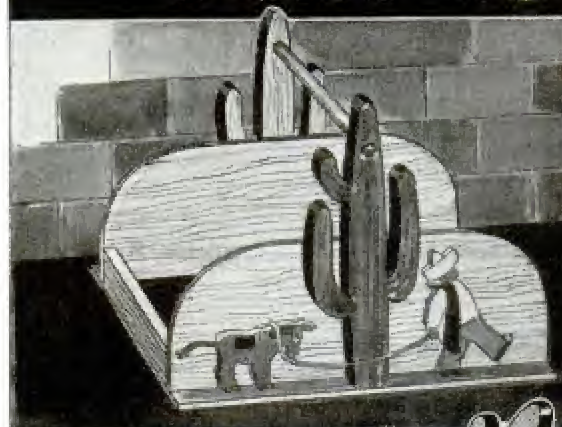
Wedges of from $\frac{1}{4}$ to $1\frac{1}{2}$ in. taper in 6 in. can be cut on a circular saw by using this adjustable jig. An adjusting screw at the rear of the jig slides against the saw fence as a wedge is being cut and thus determines its taper. The screw has a nut on either side to hold it fast after setting at the desired angle. The clearance hole for the screw is bored through the jig from side to side to permit turning the screw in for adjustment. The saw cuts a narrow wedge when the screw is extended and a wide one when it is turned in.

Dust Kept Off Fresh Finishes

You can keep dust particles off newly painted or varnished articles by drying them inside dustproof bags of the type used to store clothing. The hanger inside the bag provides a handy holder for suspending them in the sack with thread or wire.—Robert Price, Springfield, Mass.

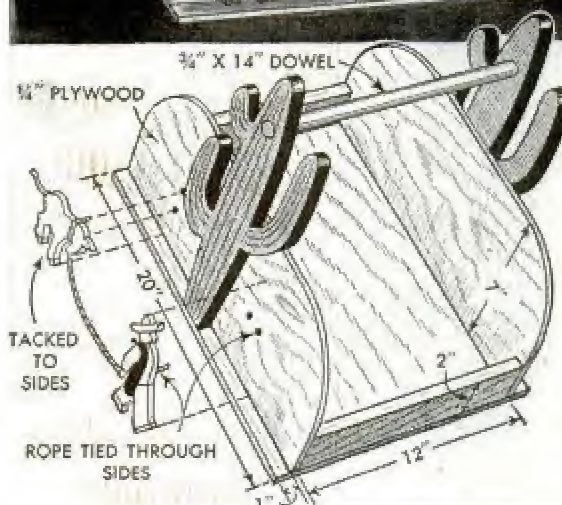


DRESS YOUR FIREPLACE



Wood basket

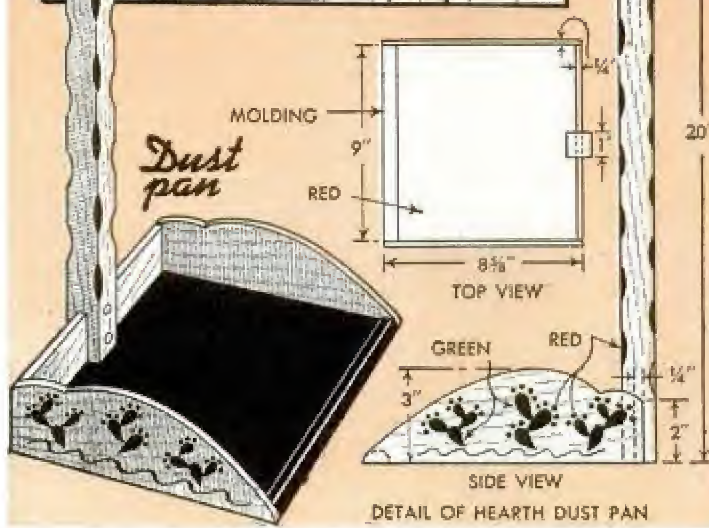
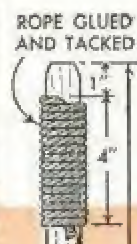
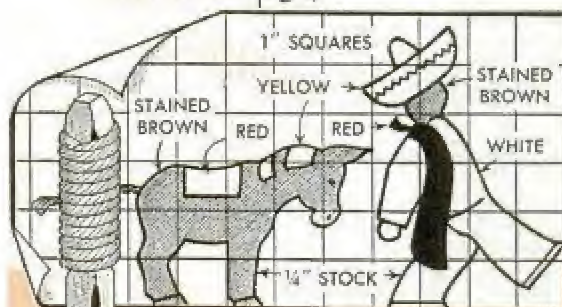
By Roberta L. Fairall



THESE fireplace accessories, touched up with the bright colors and gay figures of the old southwest, add charm to cool autumn evenings spent around the fireplace. For the wood basket, any scrap lumber will do, but plywood or tempered hard-pressed board is preferable for sides and bottom, with two pieces of $\frac{1}{2}$ -in. wood for the ends. The handle supports are jigsawed

from 1-in. stock. They should be grooved with a V-gouge to resemble cacti, drilled for the dowel and nailed in place. A short piece of rope serves for the donkey's tail, and a rope halter passes behind the man's hand through two holes in the side, knots at the ends of the rope keeping it in place.

Sides and back of the dust pan are $\frac{1}{4}$ -in. stock nailed together with a 9-in. strip of molding at the front edge of the bottom, which should be $\frac{1}{8}$ -in. hard-pressed board. A slot is cut in the lower end of the handle to fit over the back. The upper end of the handle is coated with glue and wrapped with rope tacked at the ends. Green and red cactus designs may be stenciled on the sides, and the handle left a natural finish except for notches painted red. For the nut bowl, an ordinary kitchen mixing bowl will serve. It is

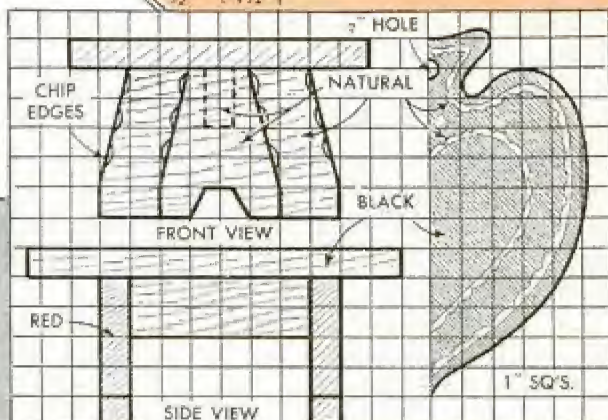
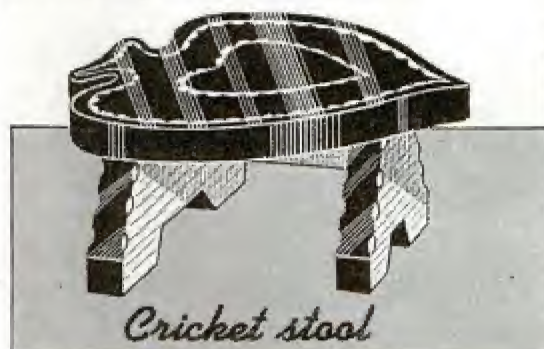
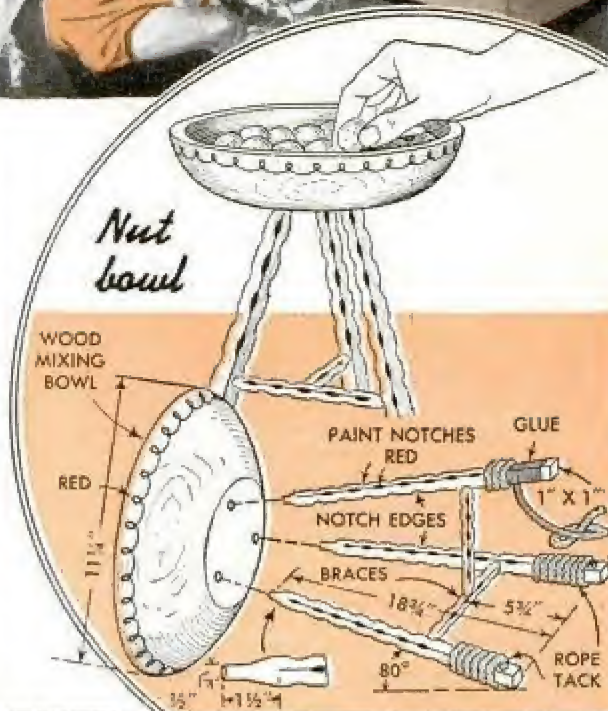


IN WESTERN TOGS

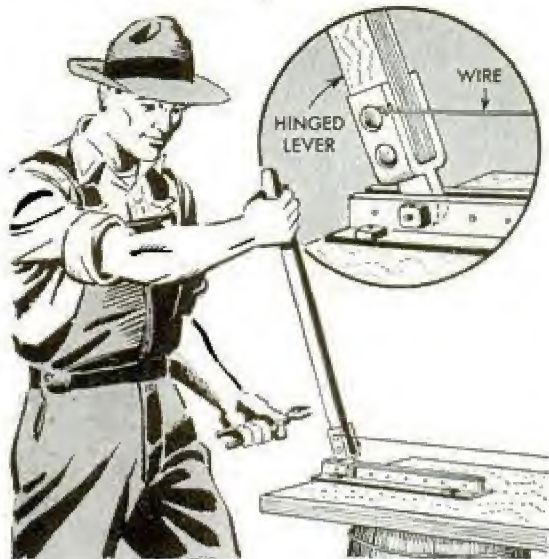


drilled for three legs which are glued in at an 80-degree angle. These are braced at the lower ends with two sticks as shown. Then rope is glued and tacked around the lower ends. The bowl will look best if left in natural finish. It can be shellacked or varnished and have a design painted around it for a border. The leg notches, like those on the dustpan handle, should be painted red.

The tiny cricket stool, shaped like the ace of spades, is sawed from 1-in. stock. The narrow front leg and wide back leg are wedge-shaped and are notched along the edges like the legs of the nut bowl. A brace is nailed between them just under the top. Since the other pieces are predominantly red and green, the top of the footstool should be enameled black for contrast with a design left unpainted on the surface as shown. Leg notches, of course, may be painted red as they are on the other pieces.



Used Baling Wire Straightened With Simple Stretcher



Most farmers find many uses for wire after it has been removed from bales of hay, straw, etc. To straighten the wire, one farmer uses a simple hand stretcher, as shown. It consists of a long plank having a lever mounted at one end and a hook at the other, between which the wire is stretched. The circular detail shows how the lever is pivoted between two pieces of angle iron, which are drilled at several places so that the spacing between the hook and lever can be adjusted to suit the length of the wire. Although not shown, a hook on the lever to receive the wire instead of twisting it under a bolt head as indicated would simplify the job.

Poisoned Ant-Bait Container Made From Small Box

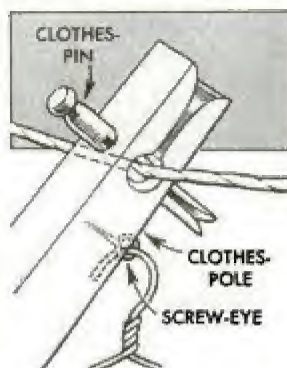


A discarded salve or pill container of metal makes a good ant-poison dispenser because, though it readily admits ants, it keeps the poison effectively hidden from pet animals and inaccessible to the prying fingers of young children. Furthermore, being flat, it cannot easily be tipped over to spill its contents on lawns or carpets. To provide entrances for the ants, three slits, $\frac{1}{8}$ in. wide, are cut in the sides to within $\frac{1}{8}$ in. from the bottom, and a piece of blotting paper, fitted into the bottom, is soaked with a poisonous solution made by dissolving sugar, 4 oz. and tartar emetic, $\frac{1}{2}$ oz. (obtainable at drug stores), in a quart of

water. A piece of cloth or small sponge soaked in the liquid is placed over the blotter, and the cover replaced. Due to evaporation of the liquid, the dispenser will need frequent refillings during warm weather.—John K. Karlovic, Chicago.

Clothesline Prop Locked in Place Against Dislodgement by Wind

If the wind sometimes dislodges your clothesline prop, here is a simple way to prevent this trouble. About an inch or so from the upper end, drill a hole for the line and make a slot from the hole to the end of the prop for in-



sertion of the line. Then drill a smaller hole through the edge of the prop to break through the larger one so that a clothespin can be inserted to keep the line in place. When a prop is fixed in this way, it is handy for supporting a garment on a hanger, which can be hooked into a screw eye driven into the prop just below the hole for the line as indicated.

Towel Rack Holds Newspapers Handy on Stand

To display an assortment of newspapers, one newsstand operator uses a couple of folding towel racks attached to the wall above the counter. The prospective purchaser can thus swing the papers into view to make a selection without much handling or possibility of soiling them.



SAVE FUEL *by Calking*

IN MOST houses, slight settling of foundations and shrinkage of materials cause cracks around doors and windows. Sometimes there will be cracks in mortar joints of masonry or stucco walls. As such cracks are heat wasters, and wall cracks in masonry may weaken the structure, all of them should be made wind and weatherproof as soon as they are noticed.

Cracks around doors and windows can be sealed best with calking compound, a material elastic enough to compensate for the movements of settling. It sticks tightly to all materials, becomes dry on the surface but remains semi-plastic underneath, and is water and weatherproof. It can be bought in several colors and in two consistencies; a soft grade that can be pressed through a calking gun, and a heavier grade that can be applied with a knife.

Application of calking compound is done most easily with a gun which pushes a ribbon of material into the cracks. Used in this way, the compound must be free from skins and lumps which might clog the nozzle. Around hinges and in some corners, it may be necessary to force down the compound and smooth it with a wooden paddle about $\frac{1}{2}$ in. wide, which has been soaked in oil to prevent the compound from adhering.

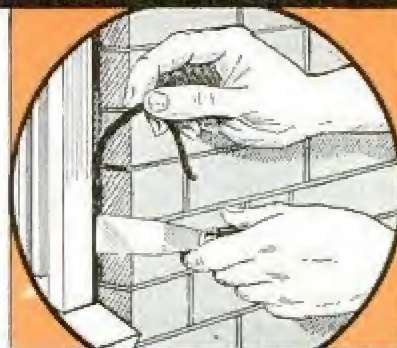
Before filling cracks, see that they are dry, and clean out all loose dirt, mortar and paint scales. Metal framework should be scraped or wire-brushed to remove rust, and given a coat of paint before calking. Wide cracks should be painted before applying the compound, but if they are more than $\frac{1}{4}$ in. wide they should be filled with oakum forced in with a blunt chisel, putty knife or calking iron and packed down by tapping the iron with a hammer until the filling comes up to $\frac{1}{4}$ in. of the surface. Cracks in masonry or stucco should be filled with cement mortar consisting of portland cement, 1 part, hydrated lime, 1 part, and clean sand, 2 or 3 parts. Wet the cracks before filling with cement, using a small putty knife or tuckpointer's trowel. When the cement is dry, cover it with a ribbon of calking compound to keep out the water.

—F. N. Vanderwalker, Flossmoor, Ill.

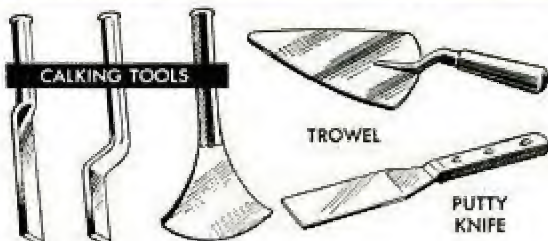
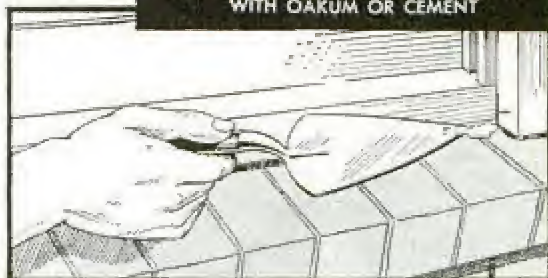
¶When polishing your car, you can obtain a more lustrous finish with less work if you apply dry cornstarch with a piece of cheesecloth just after waxing.



FIRST BRUSH OUT LOOSE DIRT



FILL WIDE OR DEEP CRACKS WITH OAKUM OR CEMENT



CALKING TOOLS

TROWEL

PUTTY KNIFE

Lamp Added to Jigsaw Is Made From Tin Can and Wood



If you have an old type jigsaw that has no lamp for lighting the work, you can make one from a piece of wood and a tin can. Cut the wood to a shape somewhat like the figure 8 and jigsaw a hole in each section, one to slip over the blower case and the other to fit a lamp socket. Remove top and bottom of the tin can, slit it up the seam and nail it to the wood as shown. The socket will be held in place when the lamp is screwed into it. The fixture may be swung aside, as it pivots on the blower case.

—Arthur F. Tuckwell, Merriton, Ont.

Sewing Machine Punches Pattern For Transferring Design

In perforating paper patterns for use with a pounce bag, I find it is convenient

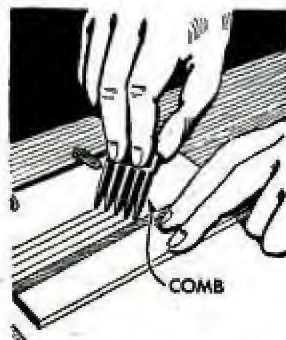


to use the sewing machine, following the design just as in sewing. It is necessary, of course, to remove the thread from the needle. Needles of any desired thickness can be used, and the stitch length can be altered as necessary.

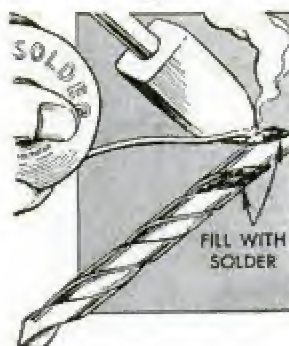
—A. H. Waychoff, Phoenix, Ariz.

Piece of Comb Rules Music Staves Quickly and Accurately

To rule staves quickly, one music teacher breaks off a piece of common pocket comb and from this breaks out as many teeth as necessary to remove all but five, equally spaced as desired. Used over carbon paper with a ruler for a guide, this comb section makes accurate staves. Two sections of this type with a suitable blank space broken out between them also rule good double staves.



Using Broken Twist Drills



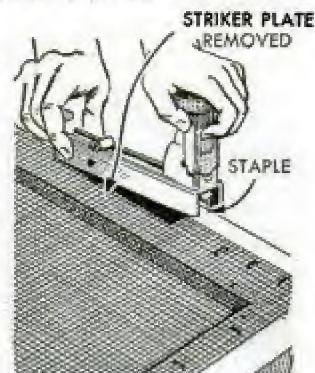
Instead of discarding a broken twist drill because it will not run true when clamped in a chuck, fill the flutes with solder for a distance of about $\frac{3}{4}$ in. from the broken end. Then file down any unevenness in the solder. This

will enable you to chuck the drill accurately so that it can be used.

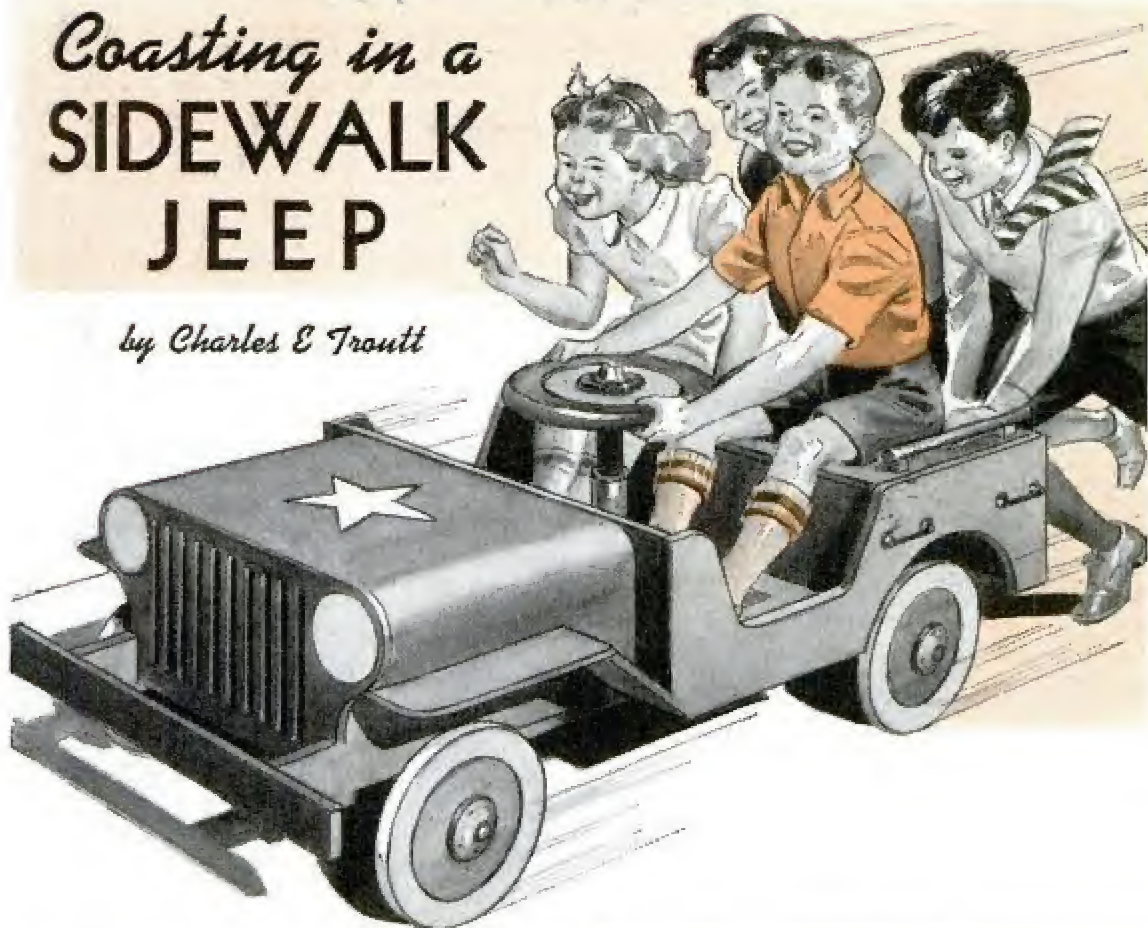
—Ralph S. Wilkes, Elbridge, N. Y.

Wire Stapled to Window Screens

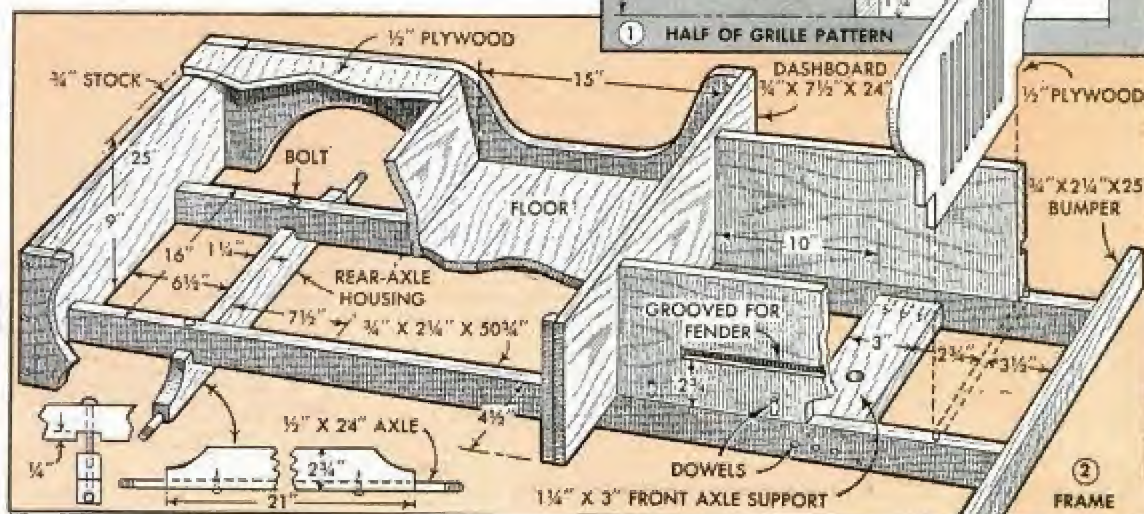
An inexpensive office stapler is a timesaver for fastening wire to window-screen frames. Also, the stapler is ideal for attaching felt weatherstripping and blanket insulation. To use the stapler, just remove the base and use the upper half as indicated.

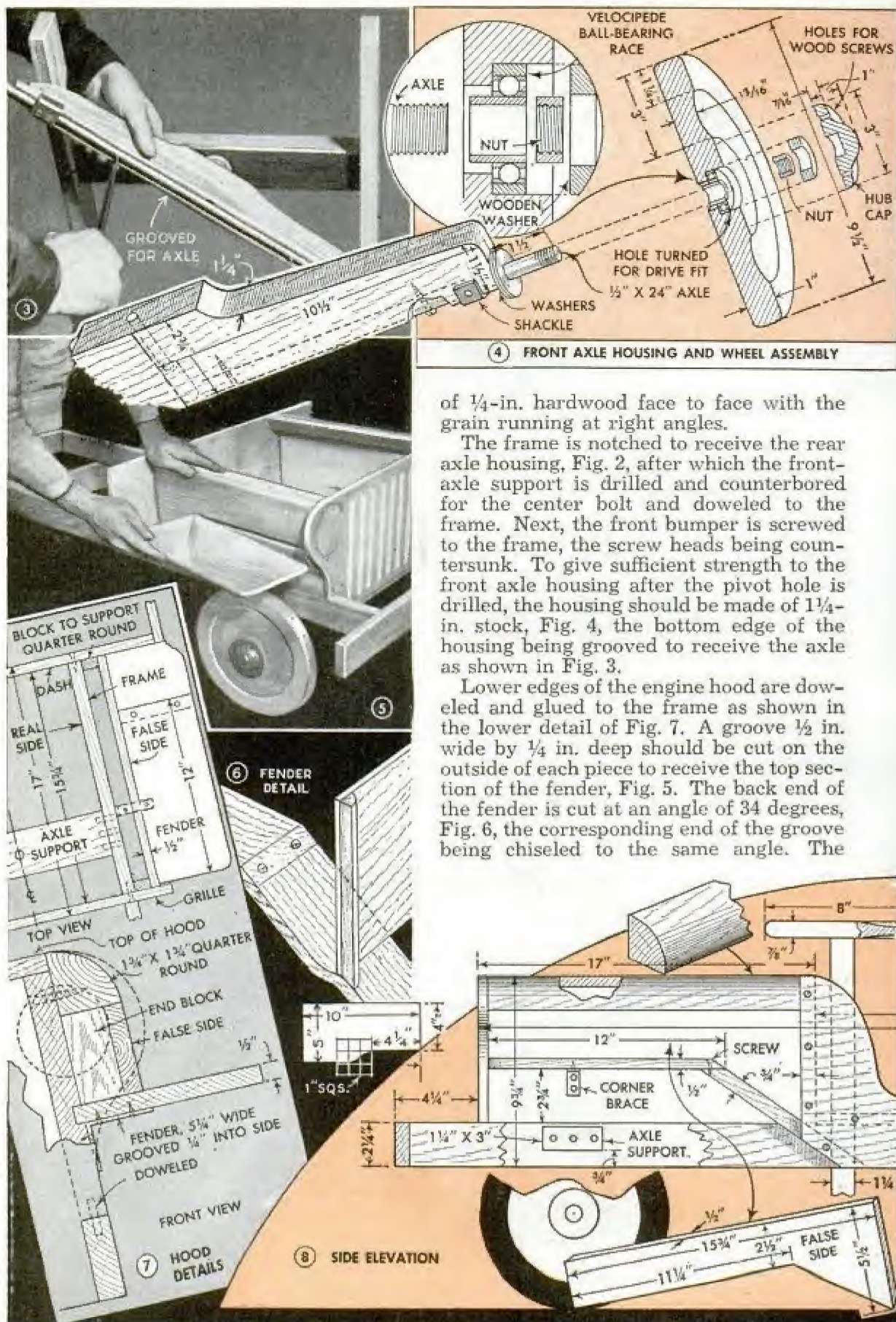


by Charles E. Truitt



1 HALF OF GRILLE PATTERN

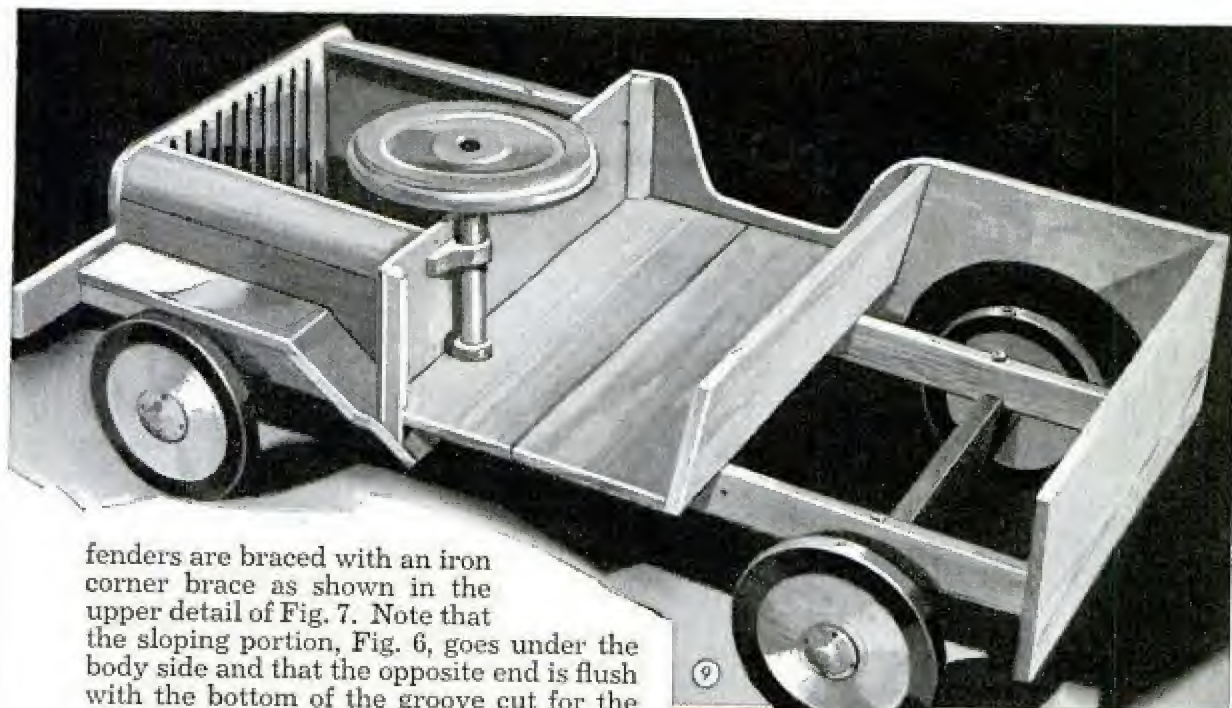




of 1/4-in. hardwood face to face with the grain running at right angles.

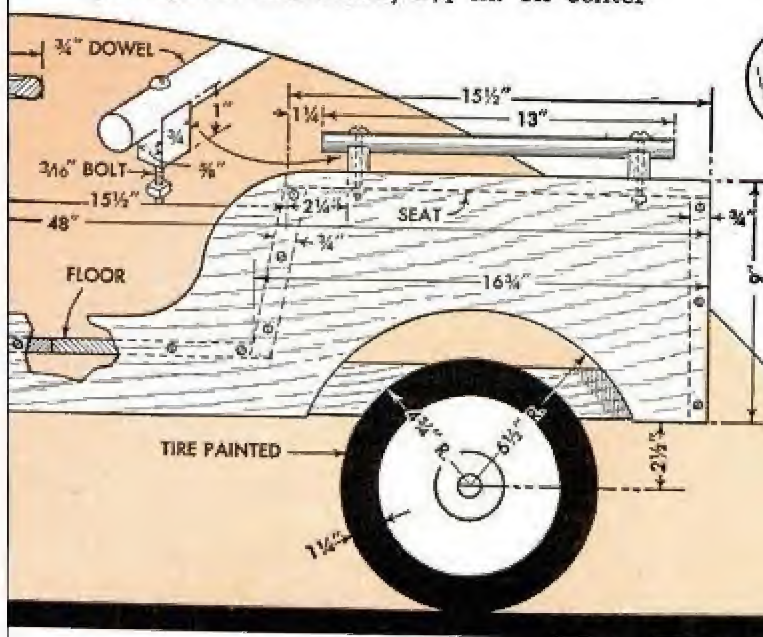
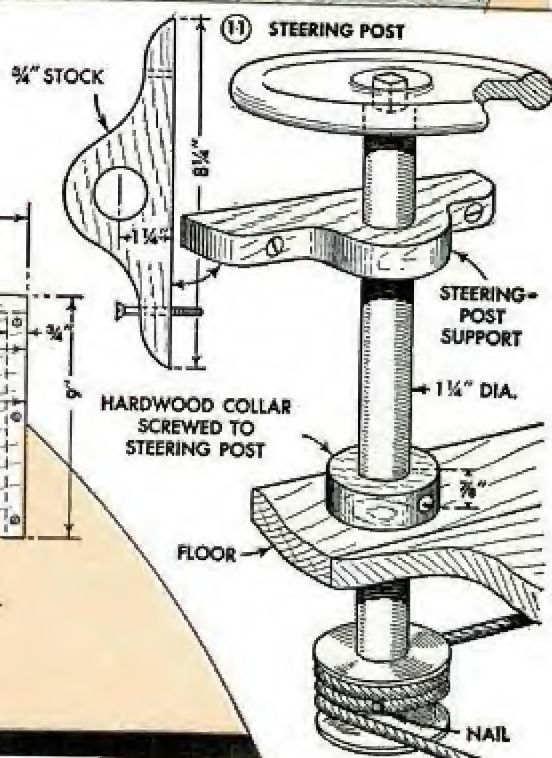
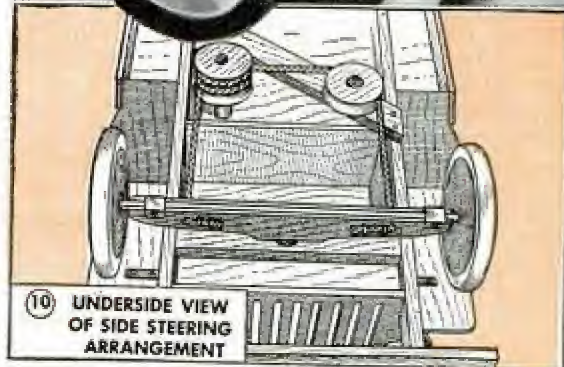
The frame is notched to receive the rear axle housing, Fig. 2, after which the front-axle support is drilled and counterbored for the center bolt and doweled to the frame. Next, the front bumper is screwed to the frame, the screw heads being countersunk. To give sufficient strength to the front axle housing after the pivot hole is drilled, the housing should be made of 1 1/4-in. stock, Fig. 4, the bottom edge of the housing being grooved to receive the axle as shown in Fig. 3.

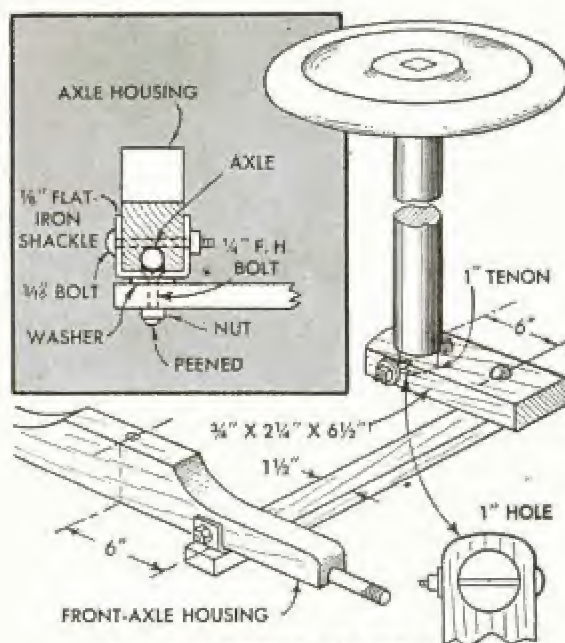
Lower edges of the engine hood are doweled and glued to the frame as shown in the lower detail of Fig. 7. A groove 1/2 in. wide by 1/4 in. deep should be cut on the outside of each piece to receive the top section of the fender, Fig. 5. The back end of the fender is cut at an angle of 34 degrees, Fig. 6, the corresponding end of the groove being chiseled to the same angle. The



fenders are braced with an iron corner brace as shown in the upper detail of Fig. 7. Note that the sloping portion, Fig. 6, goes under the body side and that the opposite end is flush with the bottom of the groove cut for the top section of the fender as shown in Fig. 9. The horizontal section of the fender is glued into the hood groove and is screwed and glued to the sloping piece.

The grill, dashboard and back are installed as illustrated in Figs. 2 and 9. The grill is laid out according to the pattern in Fig. 1, jigsawed as shown, attached to the frame by dowels. Both the grill and the dash are screwed to the ends of the hood and the back is fastened to the frame with countersunk screws. The floor is cut from $\frac{1}{2}$ -in. stock, the pieces being butted against the dashboard and nailed to the top of the frame. Before nailing the floor down, however, drill a $\frac{1}{4}$ -in. hole in the piece adjoining the dashboard, $\frac{1}{4}$ in. on center





(12) CENTER STEERING ARRANGEMENT

from the front edge, for the steering post.

The body sides are $9\frac{3}{4}$ in. high at the front and 9 in. high at the back, Fig. 8, with the lower front corner cut off at an angle flush with the fender. The two sides should be tacked together and the curves band-sawed in one operation to assure identical pieces. They are screwed to the back, dashboard, floor and back rest. The back rest fits behind the floor and extends at an angle to within $\frac{1}{2}$ in. of the top of the sides, both edges being beveled to fit the floor and seat respectively. To make the quarter round used on the sides of the hood, glue four pieces of 2 by 2 by 17-in. wood together, using paper between all joints. Turn this unit to a diameter of $3\frac{1}{2}$ in. and then split into four quarter-rounds with a chisel. Cut the false engine sides and end blocks shown in Fig. 7. Making and installing the seat rails will complete the body.

In turning the wheels, a circle 3 in. in diameter should be marked on the wheel with pencil to locate the hub which will be turned separately. Note that the hole for the bearing is cut part way through the wheel to a point which will allow the bearing to run in the center, as shown in the circular detail, Fig. 4. Be sure the hole is cut in straight so that the bearing will be tight when it is driven to the center. After the bearing is driven in, it is followed by a tight-fitting wooden collar, glued on. If, however, velocipede bearings are not available, you can turn 1-in. spindles on the ends of an oak axle and drill the wheels to rotate with a snug rather than a binding fit. With this arrangement, spindles must be kept thoroughly lubricated with graphite. To avoid any season cracks, it is well

to give the wheel a coat of shellac or sanding sealer immediately after it is finished and sanded. The tire is then painted on with slate-gray porch or deck paint.

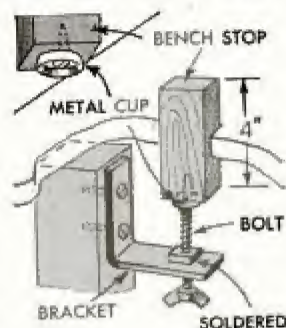
A wooden chuck is necessary for turning the hubs. It is merely a 5-in. wooden disk screwed to a 3-in. faceplate. The work is fastened to the chuck with wood screws inserted through the chuck into the work outside the area to be turned.

The steering wheel and cross arm are glued to their respective ends of the steering post after the support and collar are slipped on and the post is inserted through the floor as in Fig. 11. The support is bolted through the dashboard, all bolts being bradded to prevent their working loose. If an all-wood front axle is used, the flat-iron shackles shown in Fig. 4 may be eliminated and the steering rods bolted through both axle and housing as in Fig. 12. It is necessary that the steering rods pivot at a point directly beneath the front axle and that they be an equal distance from the center on both the housing and the steering cross-arm, otherwise the mechanism will bind when the wheels are turned. It is better to locate these pivot points when the parts are being assembled to avoid any discrepancies. If two or more youngsters are to ride on the Jeep, the steering wheel may be placed on the left side to allow more than one to ride at the same time. In this case, the steering mechanism will consist of one pulley wide enough to take three turns of sash cord with a nail through the second turn, and a second pulley over which the cord runs to connect to the axle, as shown in Figs. 10 and 11. The cord should form perfect right angles when the front axle is square with the frame.

Four sash lifts make the steps on the side of the seat. A floor mat, electric horn, and spare wheel are suitable accessories. Paint the body a dull green, and use aluminum paint for the headlamps and the star in the middle of the hood.

Turning Bolt Adjusts Bench Stop

Your workbench stop can be raised and lowered by turning a bolt which runs through a nut soldered to a $1\frac{1}{2}$ by 3-in. angle bracket attached to the bench leg. A metal cup fastened to the bottom of the stop by a counter-sunk screw provides a solid surface against which the bolt turns to force the block up.

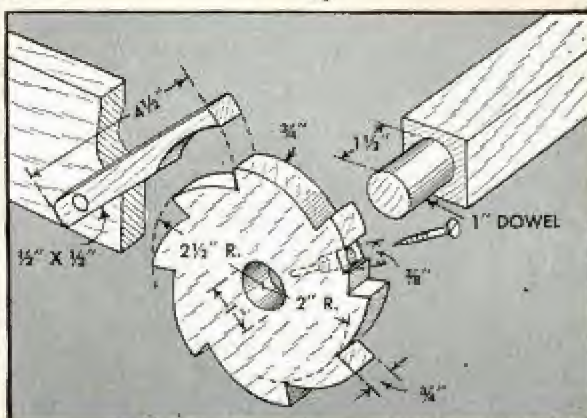
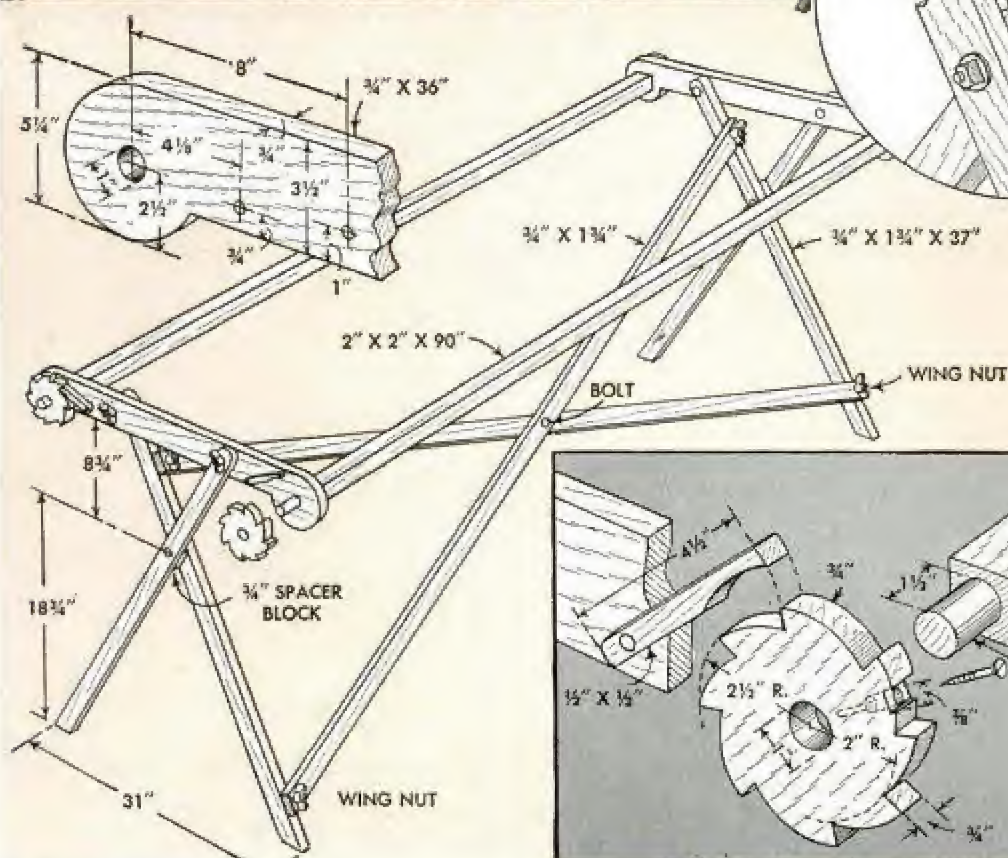
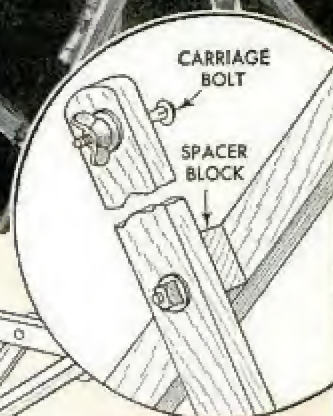


QUILTING FRAME

folds flat for storage



By removing eight wing nuts, the cross braces and legs can be folded flat against the frame for storage. The legs and braces may be of common pine, but hardwood should be used for the frame rails and ratchet wheels. The tenoned ends of the rails can be formed by gluing short dowels in centered holes, or the stock itself may be rounded at the ends with a wood rasp. Fasten quilt by sewing tape to two edges and tying to the rails



Bins Under the Garage Ceiling Store Needed Articles

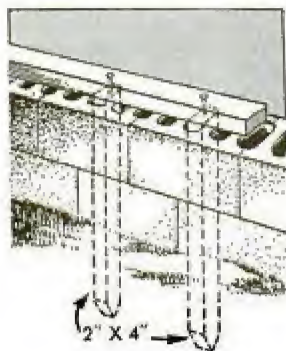


The only space generally not used in a one-car garage is the area just under the roof at the top of the walls. But this space is suitable for hanging removable storage bins in which automobile parts, tools, polishes, cleaning cloths and other miscellaneous articles can be kept. The bins are made of plywood or hard-pressed board and are attached by hardwood cleats which slide in grooved wooden strips screwed to the ceiling. A pair of handles attached as shown make removing the bin easy, and a paper label glued or tacked to the front identifies the contents.

—Opie Read, Jr., Chicago.

Temporary Concrete-Block Wall Is Easy to Build

Since no mortar is used in constructing this temporary cement-block retaining wall, future usefulness of the blocks is not impaired.



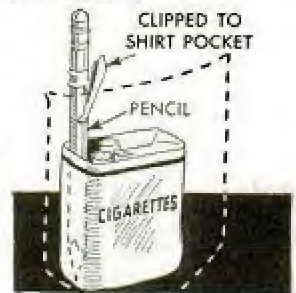
The blocks can be used for regular building work after the temporary wall has served its purpose. To build the wall, lay the blocks in the usual offset fashion to the height desired, tilting the wall slightly inward to give it retaining strength. Then as a means of locking the blocks together, insert 2 by 4-in. stakes down through their holes, driving

each stake about a foot into the ground. Saw off the extending ends and join them together by nailing a rail across their tops. If the wall is to remain standing for a considerable length of time, paint the stakes with creosote beforehand.

—J. Modroch, Danbury, Conn.

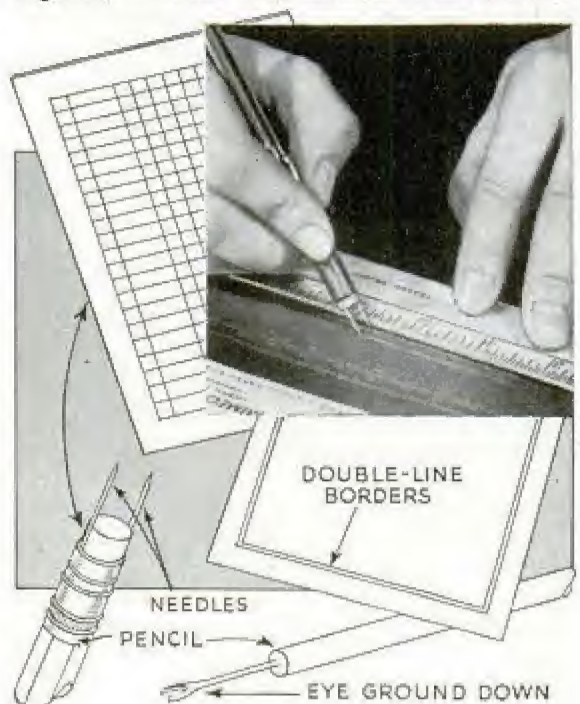
Pencil Holds Cigarette Pack In Shirt Pocket

A shirt pocket is not a very secure place for a package of cigarettes, as it is apt to drop out when stooping. A pencil that can be clipped to the pocket will hold the package in place if the point of the pencil is slipped down into it.



Parallel Lines Cut on Stencils With These Simple Styluses

Cutting parallel lines on a mimeograph stencil is simplified with this stylus, which is made by driving two needles into the ferrule of a pencil as shown. Another type of stylus for ruling double lines close together for border and other effects is made by grinding the eye of a common darning needle to provide two prongs, the size depending on the space needed between the lines. After forming the prongs, rub the ends smooth on an oil stone and push the needle into a wooden holder or the end of a pencil.—A. H. Waychoff, Phoenix, Ariz.



POPULAR MECHANICS

What You Can Do With TEXTILE COLORS



By Grant A. Waddle

WITH the new textile colors now available for stenciling on cloth, you can decorate with designs of your own making such articles of home furnishing as tablecloths, towels, napkins, pillows, and drapes as well as dresses, scarfs and other items of clothing. Or, if you prefer, you may select a readymade stencil from the many now available in sizes and patterns to suit varying tastes and requirements. The colors, which are fast, can be applied to any kind of fabric—even oilcloth.

One advantage of this method of decorating cloth is that the same design may be reproduced on all your pieces, or combined with other figures to form combinations or patterns. Then, too, you can use the same figure in several places in different colors, thereby varying the effect with the same stencil. And, best of all, you can produce



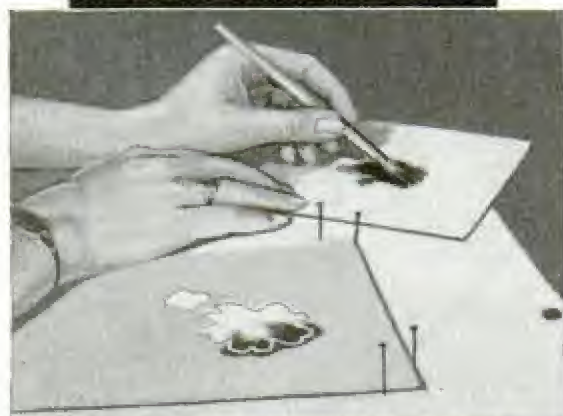
Photos courtesy American Crayon Co.

in quantity for gifts and yet have sets of finished articles for your own use.

As examples of figure-combinations, one of the photos shows the effect of combining several different figures on a tablecloth. The same design, reduced in size, can be repeated on the napkins if you wish, or a single figure may be centered on the napkins and towels. For pillows, all-over designs are attractive, or merely flowered borders used. Large flower patterns are effective on drapes, dresses and scarfs. Men's furnishings, too, can be individualized by monograms or simple figures applied to the pockets of shirts or to the cor-



WASH THE CLOTH THOROUGHLY



APPLY COLOR THROUGH STENCIL



"SET" THE COLOR WITH HOT IRON



GUIDE PINS TO ALIGN STENCILS

ner of a tie or handkerchief. Umbrellas, bags and sweaters may be similarly decorated.

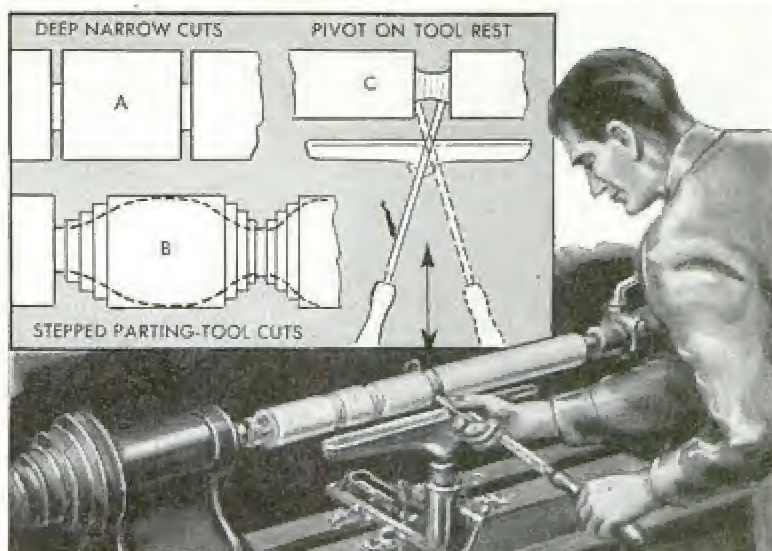
Textile colors are easy to use—there are just four steps to take in producing a finished piece of work. First wash the cloth thoroughly in order to remove the starch and sizing with which most new materials are filled. Warm, soapy water is best for this purpose. Then rinse well to remove all traces of soap, and press to dry the cloth. Stretch the cloth tightly on a drawing board or other suitable backing such as heavy cardboard that will not buckle or allow the fabric to wrinkle, and fasten the cloth with tape or thumbtacks. Put the stencil over the area you wish to color and fasten it in place with pins or thumbtacks so that it cannot move out of place. Also, be sure that the edges of the stencil are pressed tightly to the cloth, otherwise the color will seep under them and blur the outline. Apply the color with the brush which comes with the kit, using light, sweeping strokes. It is better to apply several light coats than it is to put on a single thick one. Work the color into the fabric, occasionally stippling with the end of the brush to obtain a uniform penetration. Then remove the stencil carefully, taking care not to let any part of it come in contact with the wet color to streak it. Allow the work to dry thoroughly for at least 12 hrs., although leaving it for 24 hrs. is better. Now you are ready to "set" the color. Place a damp cloth over the back of the design and iron it for at least a full minute with the iron heat at 350 degrees. For rayons, use a moderately hot iron at about 200 to 230 degrees. By dampening the pressing cloth with white vinegar instead of water you will increase the "fastness" of the color.

If the design you use calls for a combination of several colors applied to the same area with the use of several stencils, be sure to align each stencil properly so that the colors will be placed in the correct relation to each other. To do this, lay the main stencil—the one containing the major portion of the design—over the spot to be colored and set four guide pins to hold it in position and the other stencils (all same size) in position.

To make your own stencils, draw on a piece of stencil paper the pattern you wish to reproduce, or copy the design directly by means of carbon paper, and cut around the lines with a stencil knife. The stencil paper and knife may be purchased at an artists' supply house or large department store. Wall paper or magazines often supply patterns that can be used, although, of course, you can originate patterns of your own.

How to Use a Woodworking-Lathe Parting Tool

Instead of making a narrow cut with a woodworking parting tool, make a wide cut as shown at C. The narrow cut indicated at A often causes the tool to heat, and there also is a possibility that the tool may be jerked out of your hands. Besides this, the narrow cut, if deep, makes it harder to caliper the work accurately, and makes caliper necessary more frequently because it is difficult to judge when the desired diameter of the work is being approached. The wide cut is easy to make, the work being done by pivoting the tool back and forth on the tool rest. If it is desired to have a square shoulder on one end of the parted work, it can be done by making

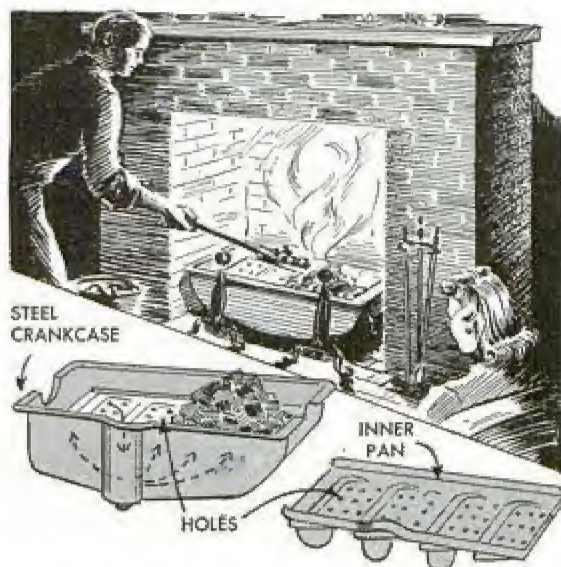


stepped cuts as shown at the left end of illustration B. Stepped cuts also can be used to make wide parting cuts as indicated at the right side of B.

Coal Fireplace Grate Improvised From Auto Crankcase

A fireplace grate that will give good service can be made easily from an old auto crankcase. One from any four-cylinder motor will fit most fireplaces, and can be obtained from a wrecking yard at a small cost. A model-A Ford crankcase is easy to alter for the purpose. Merely pry out the inner pan or partition containing the bearing troughs and punch a number of holes in it as indicated to permit entrance of air under the fuel. Replace the pan and remove the plate over the oil pump, which will permit air to enter the crankcase un-

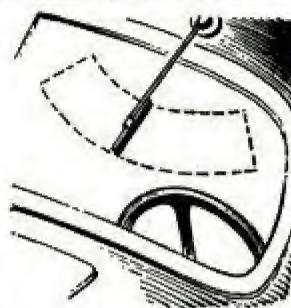
der the perforated pan when the case is set on the andirons. Before using the grate, however, it is a good idea to burn off all the oil and grease so that there will be no odor when the fireplace is put into use. If another type of crankcase not having an inner pan is used, it may be necessary to punch holes through the sides to provide a draft. You can do this with a cold chisel, making the holes about an inch square. Be sure to provide good support under the metal when punching the holes, otherwise you likely will dent and misshape the grate.



Windshield Wiper Shortened To Remove Heavy Snow

During the winter, an extra windshield wiper blade cut to about $\frac{2}{3}$ its former length and substituted for the regular long blade, will clear snow and sleet from your windshield without becoming so heavily weighted with snow that it freezes to the glass. Although the area of vision will be somewhat reduced, at least this portion of the glass will be cleared.

—R. E. Buck, East Lynn, Mass.



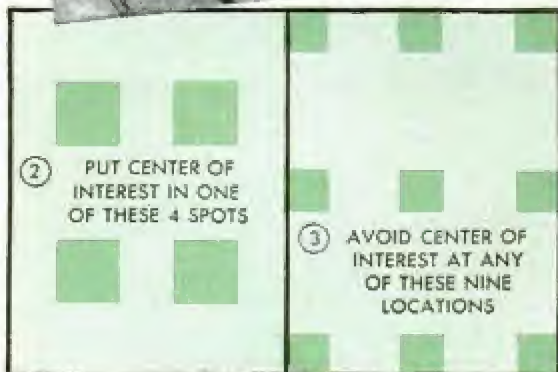


Getting **GOOD**

by Fred G. Korth

GOOD composition is the factor that makes a picture out of just a photograph. In trying to get good composition in your black-and-white photos, the do's and don'ts as given in this article are not absolutely hard and fast rules that cannot be broken. However, they have been formulated by studying accepted masterpieces of art, and keeping them in mind will pay dividends in better photography.

Most people looking at pictures have a hard time in explaining just why they like or dislike certain ones—even those that they have taken themselves. Often they are surprised when some of their shots turn out better than expected and vice versa. For instance, the finest autumn scene of colored foliage may be very drab in black and white, and it may contain too many unimportant elements. Generally, beginners get too much into photographs. Tele-



Right ⑤

④ Wrong



COMPOSITION in Your Photos

⑦ Right



phone poles and wires, tree trunks, advertising signs, door and window frames, ceiling lamps and many other objects have a tendency of creeping into the negative, surprising the unwary photographer and ruining the composition of his otherwise well chosen subject matter. A good way to eliminate the vast space outside of the camera angle and to reduce colors to a one-color effect is to look at the subject matter through a small piece of blue glass of the same proportions as the negative. By keeping the glass at a certain distance from your

eye, which you can determine by experiment, the area observed through it will be the same as that included on the negative.

Good composition and the concentration on as little subject matter as possible may turn the simplest scene into an exhibition picture. The first thing to watch is the division of the picture space. Don't divide a picture horizontally, vertically or diagonally into two fields of equal size. As soon as the area of division is about in the proportion of three to five parts, a picture begins to become acceptable. But a proportion of two to five or even one to five parts can result in a masterpiece. Division of a picture into separate areas is occasioned by



lines and masses such as horizons, trees, buildings, water lines, shadows and so forth. Often other lines or masses subdivide the main divisions of a picture. Sometimes it is desired to divide a picture into a number of repeating identical shapes of increasing or decreasing size or tonal value as, for example, a row of columns, a line of trees or a range of mountains. There are fast lines and interrupted lines, straight lines and curves of all kinds as well as suggested lines. Fast, unbroken lines lead the eye of the observer quickly in a given direction, while broken or less distinguishable lines give the observer time to linger on the way. Straight lines generally indicate strength, drama and punch, while curves suggest peaceful leisure and beauty. Suggested lines sometimes influence the pattern as much as visible ones. A person looking at something suggests a line from his eye to the object. A moving car or boat or a running child suggests a line of movement which should be considered in arranging a picture. Try to avoid having a subject or main line run toward the edge of the picture. Likewise, avoid having only one dominant curve which tends to lead the eye in an endless circle. A good picture provides an easy "entrance," a pleasant "stay" and a happy "exit" for the eye.

After these few preliminary observations, let's analyze the photographs shown in this article. Fig. 1 is a picture of slate shingles. Stacks of shingles afforded opportunities for many so-called "pattern" pictures. All-over pattern photos are those in which the theme is repeated over and over again. Pictures of this sort provide no center of interest and usually no rest for the eye. However, in Fig. 1, one stack of shingles, laid horizontally in the foreground and slightly toward the left interrupts the all-over pattern effect.

Fig. 2 illustrates where a center of interest may be placed for good composition, and Fig. 3 shows locations where it should not be placed. The application of these illustrations leads to Figs. 6 and 7. A fast moving boat needs plenty of water and, in a picture, it needs plenty of space. If you place it too close to the borders on both sides as in Fig. 6, the lack of sufficient space is noticeable. Also, you should eliminate as many of the undesired objects from the background as possible and avoid putting the center of interest in the center of the picture. In Fig. 7, the boat has been given plenty of water and the picture does not include miscellaneous elements in the background. The sweeping diagonal curve produced by the boat's wake, and the placement of the subject itself make this picture much more pleasing than the one in Fig. 6.

Often you will need more space for the center of interest than is suggested in Fig. 2. The waterfall in Fig. 4 is located in the exact center of the picture and nothing in the background or elsewhere alters this poor arrangement. Fig. 5, a photo of Old Faithful, shows how a similar subject was handled with better results. The mass of water is placed well to the left side. Clouds, groups of people, lines of foreground, forest and sky all help to balance the masses in a harmonious way. Not a single line divides the picture at the center.

Simple, everyday material makes just as good photographs as do distant beauty spots. But composition will determine how successful each shot is. Figs. 8 to 11 show what can be done. These photos are all patterns with deep shadows and bright highlights. They are bold and masculine in undertone, and include strong lines of steel girders to arrest attention. Yet, not all of them are good. Fig. 8 is poor because its lines, which crisscross the picture, scatter attention and give no rest to the eye. Fig. 9 makes a little better use of dominant diagonal lines but lacks a worthwhile center of interest. Fig. 10 is good as it has a satisfactory center of interest. This shot makes use of the old shortcut to success—getting a picture within a picture. The steel beams serve nicely to frame the building. Here is a pattern with an apparent purpose behind it. But, best of all is Fig. 11. The strong diagonal of the bridge girder cuts daringly across the building without leading the observer out of the picture. The upper edge of the dark steel is interrupted by a corner of the building while the lower edge combines curves with straight lines. Enough detail remains in the shadows of the steel and in the highlights of the sky and building to avoid the effect of so called "soot and whitewash."

According to psychologists, people involuntarily begin to look at a picture in the upper left corner from which the eye



travels gradually toward the lower right corner—perhaps a habit formed by reading. Although diagonal lines help to create strong photographs, one running from the upper left to the lower right aids the tendency of most people to follow this path naturally, and quickly leads the eye right out of the picture. Such diagonals, therefore, should be avoided. On the contrary, it is better to place strong diagonals from the lower left to the upper right, as shown in Fig. 11, as they stop the eye that tends to move from upper left to lower right. If a subject is such that you cannot avoid getting a wrong diagonal, it is possible to save the situation by turning the negative over when making a projection print, thus reversing it.

Not every picture is designed to stop the observer. Many photos are intended to focus attention on the beauty of Nature and her seasons. Everybody feels a desire to go out and get some fine scenes of newly



fallen snow settling on trees and houses, which may be particularly true because of the rareness of the occasion. Such snow scenes are shown in Figs. 12 and 13. Although they have much in common, the one in Fig. 13 shows the better composition. The streets cut across Fig. 13 at a greater angle than in Fig. 12. Also, human interest has been added to Fig. 13 in a good location. Painters call the human element of this kind "staffage." It not only adds life, but proportion as well. It should not dominate the scene and become the center of interest.

Fig. 15 is a typical example of the folly of trying to get too much into a photo. There is a skyline of buildings, a ship, water, sky and an advertising sign. The division is horizontally across the photo and the shot, judged from the angle of composition, belongs in the wastebasket. Fewer similar elements grouped pleasingly are shown in Fig. 14. Note the suppression of unnecessary details in the shadows. Buildings, lamp posts and foreground lines suggest a diagonal alignment, although most of the visible lines are vertical.

The same general ideas also apply to photos of people. When taking one merely as a record shot or for identification, little

thought is given to composition, but to produce a pleasing effect, lines and masses must be taken into consideration. Examples of such photos are Figs. 17, 18 and 19. In Fig. 17, the subject assumed the usual pose for having a picture taken, but the result, compositionally, was a failure. The Indian, shoulders squarely facing the camera, stands against a wall while the black windows and the design of stones detract from the subject. Figs. 18 and 19 avoid these pitfalls. In Fig. 18 the bow and arrow lend interest. All lines with the exception of those of the bow are pointing toward the head. In Fig. 19, sand was chosen as a background instead of sky. Here a Pueblo medicine man is making a sand painting. His arms, leg and body, the trays of sand and the painting fit into a composition of diagonals. None of these lines dominates





everything else, though the painting is emphasized most. All elements follow each other in a circular movement that forms a harmonious whole.

Fig. 16 shows a still-life photo which has a pleasing composition. This would not have been the case if the hourglass had been set in the center with the money directly underneath and the foreground had been allowed to blend into white. With the hourglass far to the side, its shadow a suppressed diagonal, and with the money forming another diagonal, an interesting result was obtained. A picture of this type has simple lines, yet is bold enough to catch the eye and demand attention.

Focusing in Poor Light Easier When Ground Glass Is Oiled

The image will appear much brighter when you are focusing under poor light conditions if you apply a small amount of machine oil to the etched side of the ground glass. The oil should be very light and need only be applied to a small area of the glass.—Wm. Swallow, Brooklyn, N. Y.

Flash of Photo Bulb More Certain If Tip Is Sanded Before Use

Sanding the tips of flash bulbs removes any possible tarnish, insuring a better connection which makes the flash more certain. A small square of fine sandpaper glued to the side or back of the camera will serve the purpose and act as a reminder before use.—Phil Lance, Philadelphia, Pa.



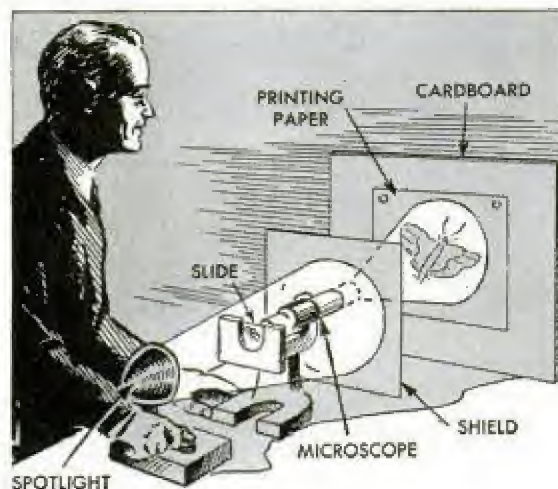
Dust Removed From Negatives By Statically Charged Rod



In enlarging and printing, dust particles that are usually so hard to remove from the negative will come off easily, especially in cold weather, when a statically charged glass rod is passed along both sides close to the surfaces. Rubbing the rod briskly for a few seconds on a scrap piece of fur or silk will charge it.

How to Make Photomicrograms Without Using a Camera

You can make photomicrograms satisfactory for most purposes without the use of elaborate equipment, even without a camera, by merely projecting the image from a microscope directly onto photographic printing paper, which then is developed in the usual way. The drawing



shows the setup. The microscope is used in a horizontal position with a strong spotlight directed on the specimen slide so that the image is projected onto a cardboard easel placed about 1 ft. in front of the eyepiece. A large shield, through which the eyepiece projects, prevents direct illumination from reaching the easel. After focusing the microscope, a piece of printing paper is put on the easel and given an exposure of about 6 seconds, depending on the strength of your light source. Of course, the exposure must be made in a dark room.—Ira Laufer, New York City.

Effect of Diffusion Enlarger Gained With Opal Glass

Improved tone value and detail possible with diffusion enlargers often can be obtained with condenser enlargers by placing a piece of flashed opal glass on the top of the negative carrier and inserting the com-



bination into the condenser enlarger. If your enlarger uses a glass "sandwich" carrier, substitute the sheet of opal glass for the top glass, with the rough surface always toward the light source.

Keeping Shutters From Freezing

To keep camera shutters from slowing up or stopping due to cold weather, miniature cameras and others which are small enough should be carried beneath the outer clothing. This will warm the shutter lubricant sufficiently so that it will not congeal.—Pfc. Bernie Aumuller Minneapolis, Minn.

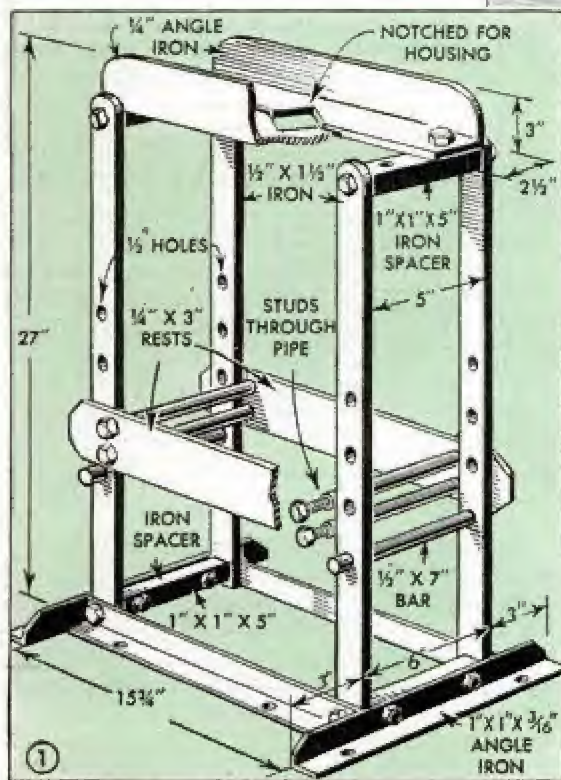
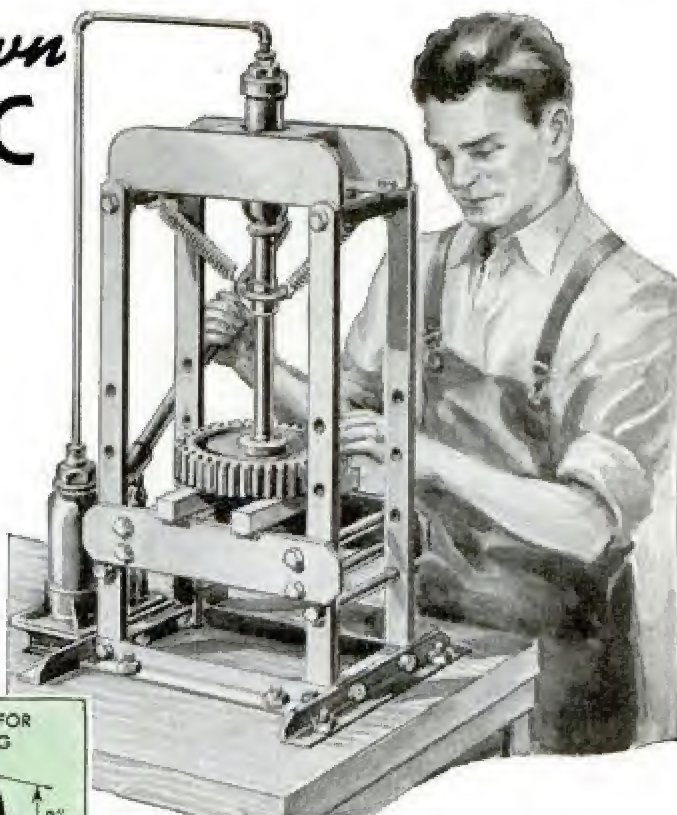


SHOP NOTES

Make Your Own HYDRAULIC PRESS

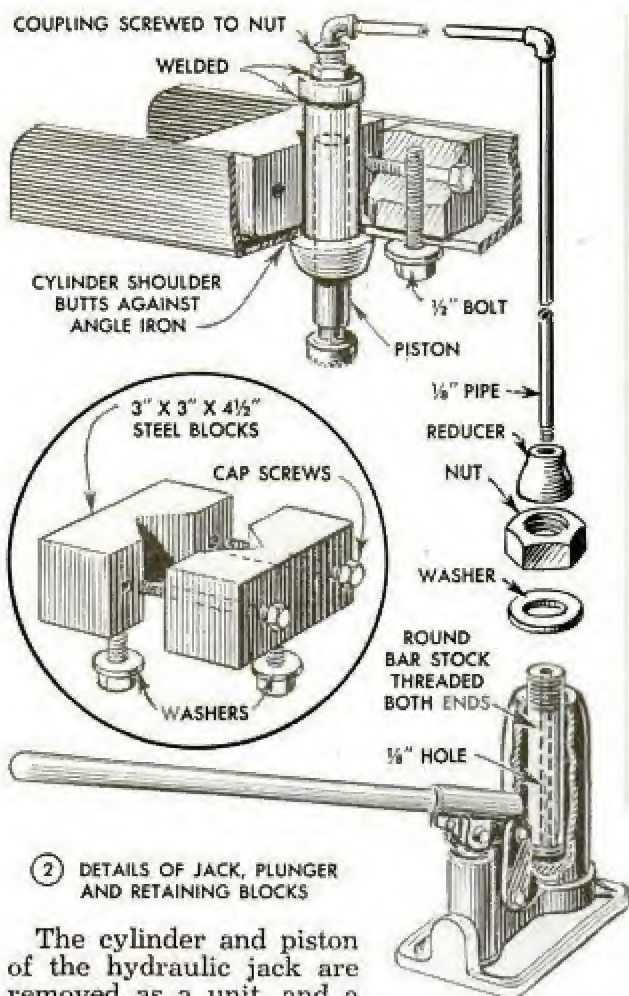
By E. S. Harris

FOR fitting bushings into connecting rods, forcing gears on shafts, removing axles from small wheels and similar work in the garage, service station or shop, a hydraulic press like the one illustrated will do the job quickly and efficiently. It consists of a hydraulic auto jack, some pipe and pipe fittings and a frame made from odds and ends of scrap iron usual-



ly available at garages and machine shops.

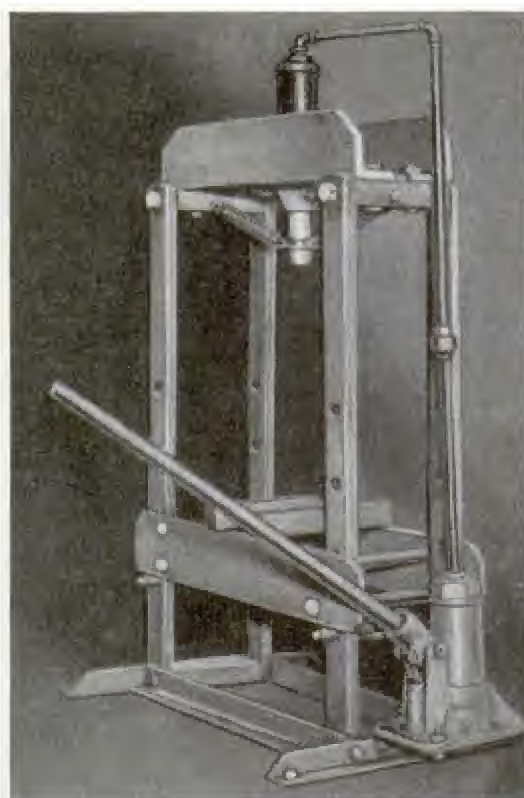
Four pieces of angle iron forming the base are bolted to the workbench, and the uprights are attached with $\frac{1}{2}$ -in. bolts. Four spacers, shown in Fig. 1, are drilled and tapped for $\frac{1}{2}$ -in. bolts which hold them to the uprights. The top of the press is made from two lengths of angle iron which are bolted to the spacers. A notch is cut in each piece of angle iron through which the jack will be inserted later, and two steel retaining blocks, similarly notched as shown in the circular detail of Fig. 2, are drilled and tapped for two $\frac{1}{2}$ -in. bolts on each side and on the underside to receive a similar bolt extending through the slot where the pieces of angle iron butt together. The adjustable rests are supported at any one of four positions by bars placed through $\frac{1}{2}$ -in. holes spaced at 3-in. intervals in the uprights, and are held together tightly by four studs running through sections of iron pipe.



② DETAILS OF JACK, PLUNGER AND RETAINING BLOCKS

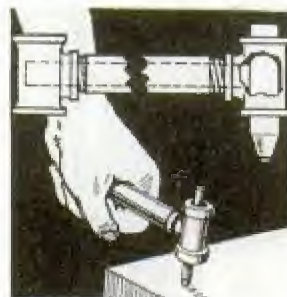
The cylinder and piston of the hydraulic jack are removed as a unit, and a piece of round bar stock of the same diameter and length as the cylinder is substituted. A hole is drilled through it lengthwise for the passage of fluid, and the ends are threaded, one end to screw into the base of the jack housing, the other to take a nut and pipe reducer into which the feed pipe is to be fitted. After the bar is screwed into the housing, a washer is placed over it and the nut turned down tightly to prevent loss of fluid. It may be necessary to put a gasket under the washer as a seal. Instead of using a reducer, the feed pipe can be threaded and fitted into a counter-bored, tapped hole in the bar.

Next, make a housing for the cylinder and piston. This is made from a length of 1 $\frac{3}{4}$ -in. iron pipe about half as long as the cylinder, welded to a metal base which is threaded like the jack housing to receive the cylinder, and is drilled for the passage of fluid. A nut is welded to the base and a feed-pipe coupling screwed into it. The cylinder and piston in the substitute housing are mounted on the frame as shown in the upper detail of Fig. 2, with the end of the housing resting on the angle iron and the cylinder shoulder butting up against the underside of the angle iron. The hous-



ing is clamped securely between the retaining blocks. In this position, the piston will press down on the work when fluid is pumped into the cylinder. The feed pipe is attached by couplings and elbows, and the jack is supported by a brace at the side of the frame. Coil springs, attached to the frame spacers by eye bolts, pull up the piston and force the fluid back when the valve is released.

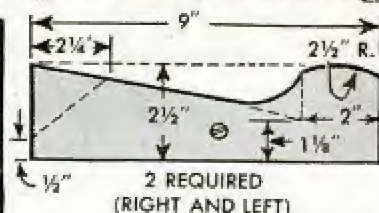
Holding Marking Die in Pipe Tee Prevents Injury to Workman



After repeated pounding with a hammer, the dies used in stamping numbers, initials, or other identifying marks on metal parts become rounded on top, permitting the hammer to strike a glancing blow which may hit the workman's fingers and so cause damage and loss of time. To avoid this threat of injury, one worker designed the die holder illustrated. It is made from two $\frac{3}{8}$ -in. pipe tees joined by a length of $\frac{3}{8}$ -in. pipe within which a $\frac{1}{4}$ -in. pipe is inserted. With the die slipped in place, the tees are turned to tighten the inside pipe against it, thus holding it firmly.

Adjustable Stop Holds Work Upright for Planing

Accommodating work from $\frac{1}{8}$ to $1\frac{1}{4}$ -in. thickness, this handy bench stop holds the work in an upright position for planing and other operations. The stop is made from two pieces of hardwood, about 1 in. thick, to the dimensions given in the sketch. The two pieces are right and left hand, the miter half-lap being on the top on one piece and on the bottom on the other. The stop is mounted parallel with the side of the workbench, with about $\frac{1}{16}$ in. separation between the two pieces. A 2-in. No. 10 round-head wood screw driven through each half of the stop into the bench top anchors the stop, the screws being located at midlength as shown in the detail.

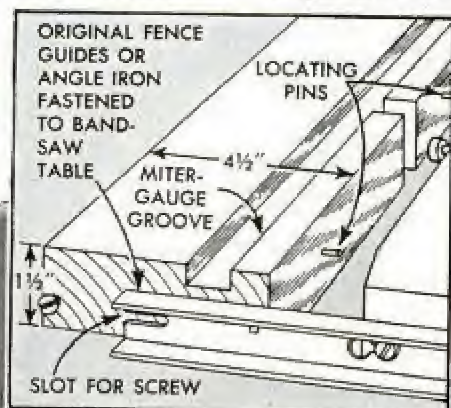
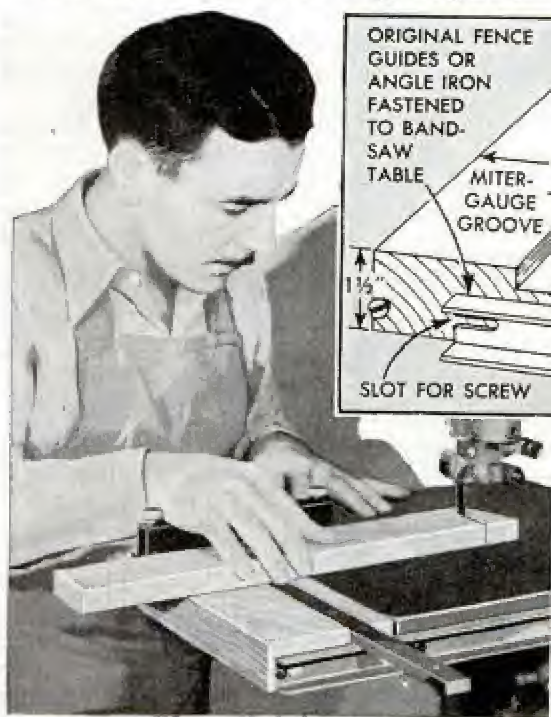


Extension Table Permits Use of Miter Gauge on Band Saw

It is frequently helpful to use a miter gauge on the band saw for cut-off work. If your saw does not have this feature, make an extension table of wood, and fasten it in place by means of guide pins into

the band-saw table, plus two screws which fit slots cut in the ends of fence guide rails. If your saw does not have fence guide rails, the extension table can be fitted to short angle-iron arms. The miter-gauge groove

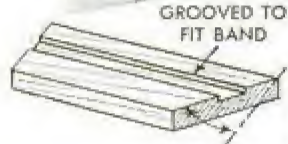
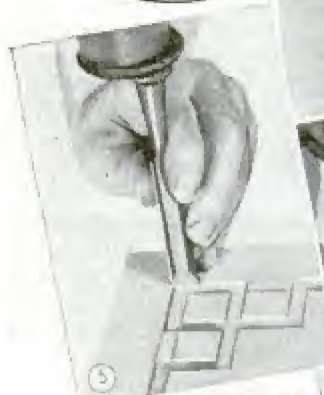
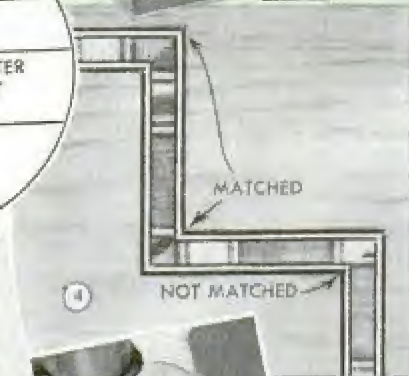
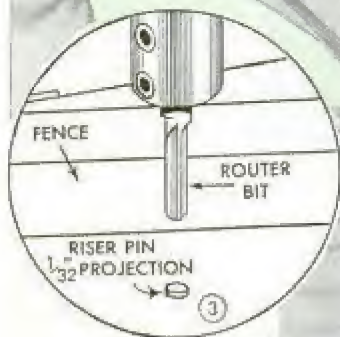
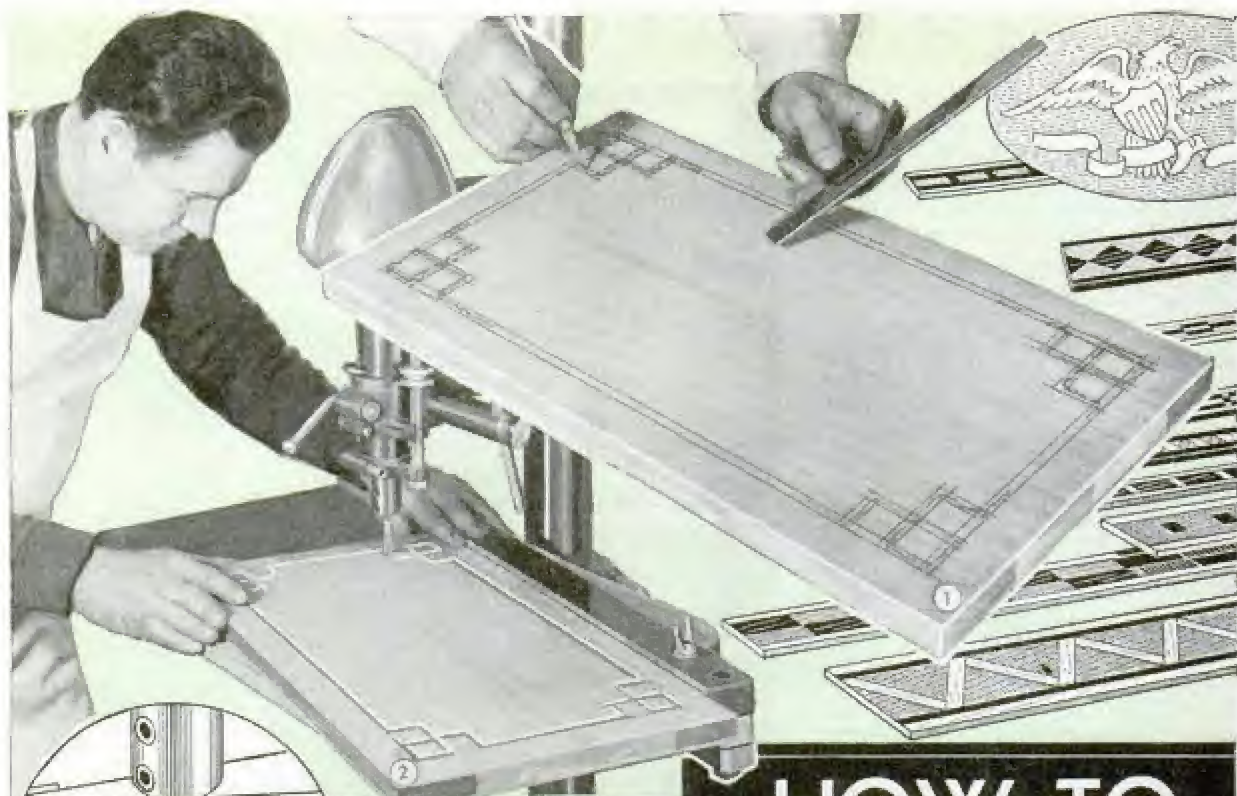
in the wood table should be made the proper size to take the circular-saw miter gauge. The gauge can be fitted with a wood backstop for supporting the work when cutting off close to the blade. The wood table should be exactly flush with the top of the regular band-saw table, and need not be removed except when it is necessary to change the blades.



Glue Stops Stain Penetration

Stains will not "bleed" through paint if the stained surface is well sanded then covered with waterproof glue mixed to the consistency of cream. Two coats should be applied, allowing the first to dry thoroughly before applying the second. A priming coat of paint also makes better results.

—C. L. Cronk, Washington, D. C.



BLOCK TO CUT
INLAY BANDS
AT 45° ANGLE

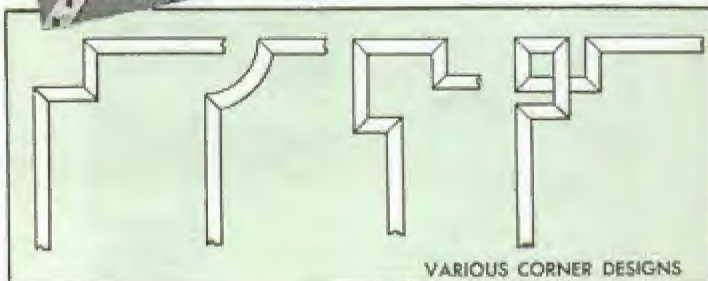


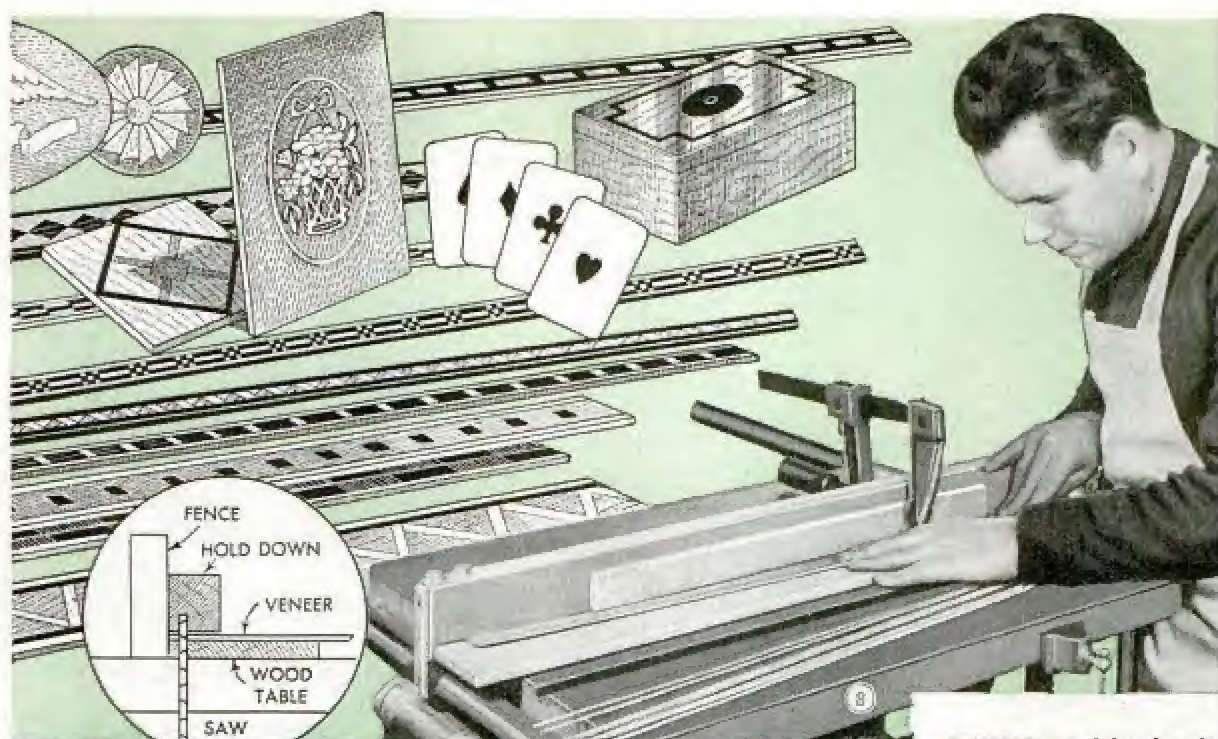
HOW TO

INLAY bands and designs offer an attractive and easy-to-work medium for the enrichment of small boxes, table tops, drawer fronts, book ends and many other craft projects. Of course, such decorating can be overdone but, judiciously applied, a touch of colorful inlay will improve almost any project.

Inlay bands: These are sold in yard lengths ranging in widths from $\frac{1}{8}$ to 1 in., and the design itself embraces about a hundred standard patterns. The first step in inlaying a band or border is to mark off the design on the work, Fig. 1. The necessary

INLAY BANDS, obtainable in many different patterns, add color to any project. Routing of recess is done on the drill press at a speed of 5,000 r.p.m., using a fence to guide the cuts. Grooves across the grain of the work should be cut first. Various corner designs for tables and boxes are shown at right



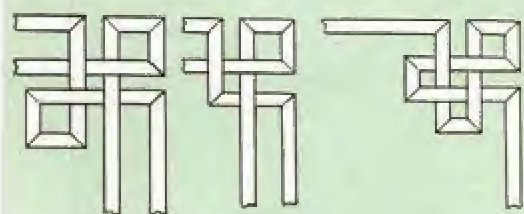
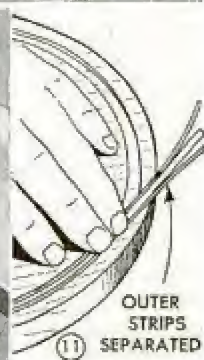
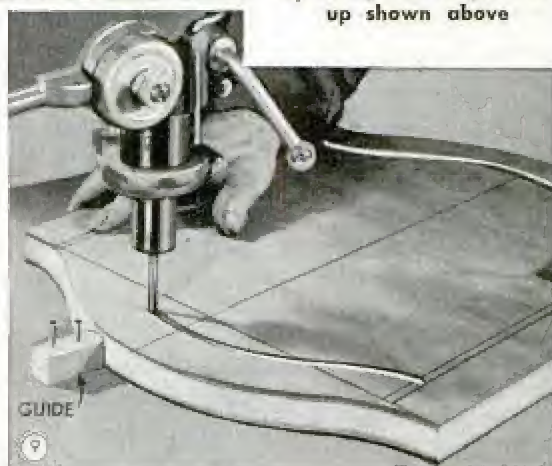


WORK *with* INLAYS

STRINGS are inlay bands, cut from solid veneer or thin plastic, which can be purchased, or can be sawed from sheet veneer by using the simple set-up shown above

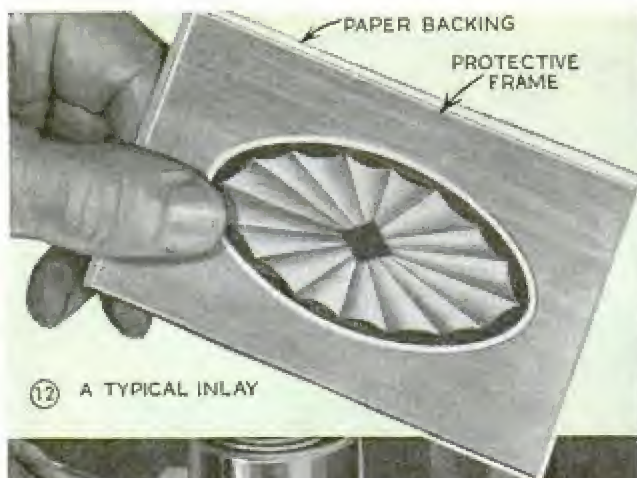
recessing then is done with a single or double-flute router bit of the same diameter as the width of the band. Cuts across the grain should be run in first, after which with-the-grain cuts at the same fence setting can be made, Fig. 2. This method of working will avoid tearing the wood at the end of the cut. The depth of the recess should be a little less than the thickness of the inlay band. If the work is slightly warped, it is advisable to work over a riser pin, as shown in Fig. 3, to assure a groove of uniform depth. The drill speed should be no less than 5,000 r.p.m. After routing, it is necessary to clean the corners with a sharp chisel as in Fig. 5. The inlay band itself can be cut with chisel and guide block, Fig. 6, or the miters can be rough-cut and then sanded smooth, Fig. 7.

Miter joints should be matched

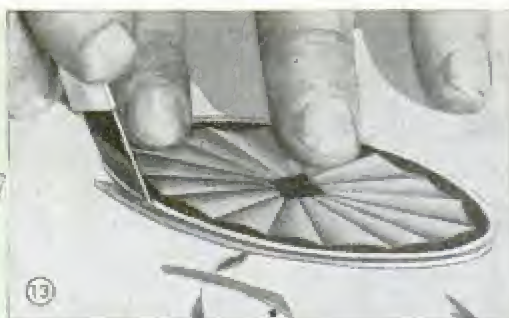


POSSIBLE WITH INLAY BANDING

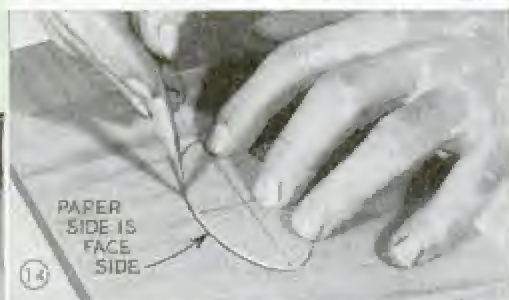
CURVES are routed by using a guide pin or, if the work is circular, a V-block or pivot pin



12 A TYPICAL INLAY



13



14



15

INLAYS are purchased ready-made and are fitted by routing them freehand on a drill press or with rotary hand tool

(see Fig. 4). If you use the chisel method of cutting, trimming to the exact miter line, perfect matching, Fig. 4, will be obtained by simply turning one of the pieces over. If the miter is not correct, it should be sanded down until the design comes to the proper repeat position for matching. Some borders permit mismatching; others expose a mismatch like the proverbial sore thumb.

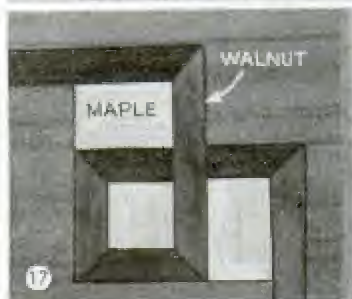
Strings: Strings are inlay bands cut from solid veneer, celluloid or thin plastic. The method of cutting shown in Fig. 8 permits ripping of strings as narrow as $\frac{1}{16}$ in. with perfect accuracy. The application is the same as for ornamental banding. Another method of making strings is to use veneer of a thickness

equal to the width of the banding required.

Banding of curves: The average inlay banding will take moderate curves. Cutting the recess requires a pin guide as shown in Fig. 9 or, if the work is circular, a V-shaped guide or pivot pin, Fig. 10. Curves should not be attempted with banding over $\frac{1}{8}$ in. wide. Fitting on abrupt turns is easier if the banding is heated. If this does not turn the trick, the banding can be wetted to permit peeling the outer strips free as in Fig. 11. In this condition, the various separated strips will slide past each other, permitting abrupt turns.



16



17

SOLID CORNERS, built up from lumber stock, have many advantages in production work. The design is completed with veneer strings

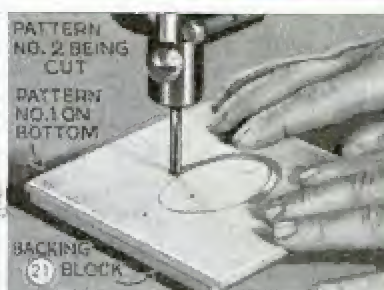


18

Inlays: This word in itself indicates a built-up pattern design as shown in Fig. 12. The design is surrounded with a protecting veneer frame, and the whole thing is backed with paper, the paper side being the face side. Band-saw around the design and then trim to the joint line with a knife, as in Fig. 13. Using the inlay as a pattern, mark around it onto the work, Fig. 14. Note that the paper side is up. Cut the recess free-hand, using a square-nose carving cutter mounted in a drill press, Fig. 15, or a rotary hand tool, Fig. 16. The carving cutter does not

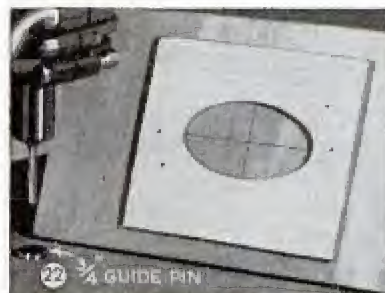
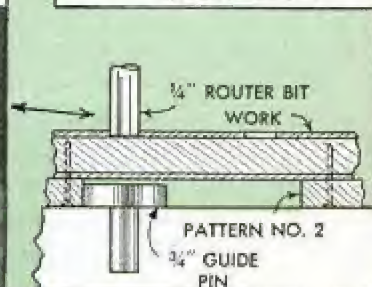
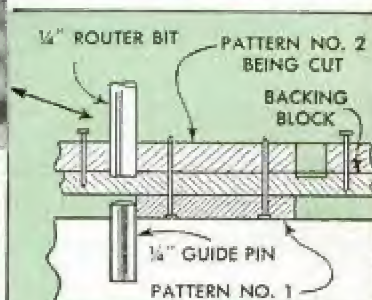


Fit inlay on 3/16-in. plywood and saw; then sand pattern, taking off a little of the inlay to assure pattern of exact size



Fit pattern on underside of backing block and rout pattern No. 2, using 1/4-in. router bit and 1/4-in. guide pin. Rout in 2 bites

DOUBLE PATTERNS provide a good working method of inlaying the same design in production work, such as the box shown above



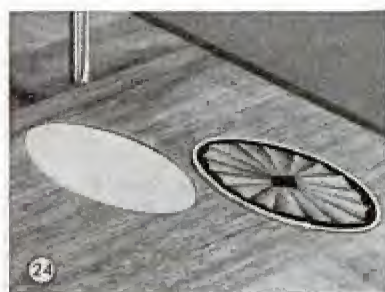
Center pattern No. 2 on underside of work. Be sure face side is up. Fit 1/4-in. guide pin. Do not change setup of router bit



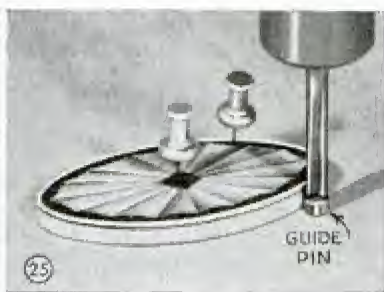
Rout the recess, cutting to a depth a little less than thickness of inlay. This part is easy since pattern supplies positive control

kick like a single or double-flute router bit, and it is quite simple to trim the recess exactly to the pencil line. Freehand cutting of this kind is recommended for all jobs where a single inlay is to be fitted; other methods using patterns are best for production work, as will be described later.

Solid corners: A type of inlay border using a solid built-up corner is illustrated in Fig. 17. The work is built up in a thickness of about 1 in., which, when ripped on



Leave pattern in place and rout out freehand the wood in center of recess. Go around the outside again to assure a full cut



Other inlays of same pattern are shaved to exact size by using pattern No. 1 with 1/4-in. guide pin and 1/4-in. router bit

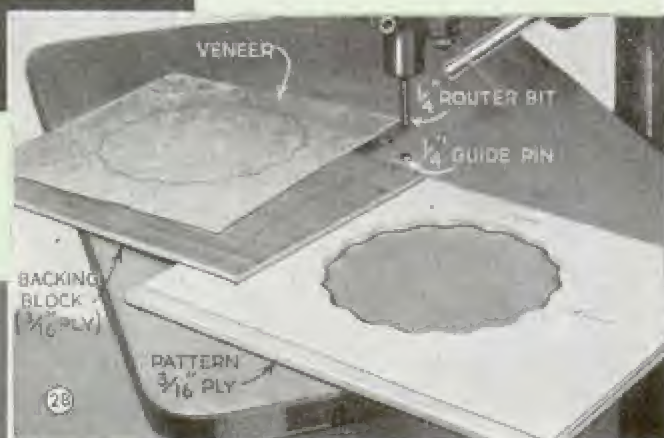


27

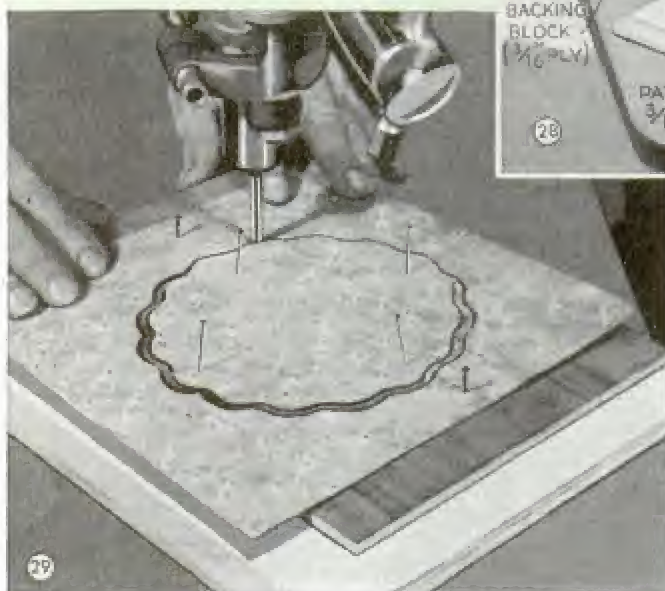
VENEER INLAYS are cut from solid veneer of contrasting color. One pattern is used for cutting both the inlay and the recess



26 A PLAIN VENEER INLAY



28



29

and a tight fit for the pins. Keep in mind which side of each pattern is the face and work accordingly. In the popular oval designs, it is not at once apparent that the design has a right and left side. This feature is at once apparent when working an inlay like the inlay letter B shown in Fig. 30. Work all symmetrical designs the same way.

Veneer inlays: Single or production work on plain veneer inlays, Fig. 26, is best done with a pattern, the pattern serving as a guide for both inlay and recess.

the band saw, Fig. 18, supplies several corner pieces. Joining strips are plain veneer, ripped to the required width.

Double patterns: This method is useful when the same stock design is to be inlaid several times, such as production work on a box like the one shown in Fig. 19. Start by sawing and sanding a pattern of the same size as the inlay, Fig. 20. Follow the successive operations as described in the captions of Figs. 20 to 25. A 1/4-in. double-flute router bit is used in these operations and is the best size for average work. Two guide pins are used, one being the same diameter as the router bit; the other, three times the diameter of the bit, less about .005 in. These should be turned from metal and must be exact. The fitting hole in the table must be exactly under the router bit

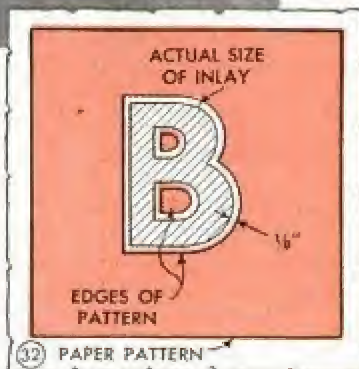
With slight variations, this is the same as the system already described. The pattern is scrollsawed as in Fig. 27, using a fine blade to get a smooth, regular outline. No particular dimensions need be followed, except it should be remembered that the inlay will be smaller than the pattern by the size of the router bit. Fig. 28 shows the setup for cutting the veneer, using 1/4-in. router bit and 1/4-in. guide pin. Fig. 29 shows the veneer being cut. The pattern must be kept tight against the pin to avoid cutting the veneer undersize. As a visual guide, it is good practice to center and mark the design with pencil on the veneer before starting the routing operation. After the veneer inlay has been cut, the same pattern is fitted on the underside of the work, and the recess is cut, using the same



router bit but with the $\frac{3}{4}$ -in. minus guide pin. Cutting the recess is the simpler of the two operations since the pattern in this case supplies a positive guide so that overcutting is impossible. Go around the work twice to make sure that you are out to the full limits of the pattern.

Inside cuts: These, such as the letter B, Fig. 30, are worked the same as solid veneer inlays except that the pattern is a bit more complicated. The design should be drawn actual size, after which the actual lines of the pattern are set off outside the inlay, Fig. 32. The setup recommended is the $\frac{1}{8}$ -in. router bit. This requires a $\frac{1}{8}$ -in. guide pin for cutting the inlay, and a $\frac{3}{8}$ -in. (minus) pin for cutting the recess. Fig. 31 shows the work finished and the pattern turned over. It will be apparent that the size of the work is limited by the inside cuts, which must be large enough to permit taking-off and still leave wood enough for handling and mounting. Do not destroy the paper design when doing work of this kind since it will be needed in properly positioning the inside parts of the pattern. Obviously, this method is useful only for production work; if the job is a single piece it can be inlaid much quicker by using the freehand method of cutting the recess.

Finishing: Use cold resin or hot glue for mounting, applying glue to recess only. Avoid using any kind of glue which stains. Banding will usually stick without clamping; inlay designs should be clamped under a board with paper between. Allow the glue to dry thoroughly, then sand the inlay flush, finishing with no coarser than 4/0 paper. The best finish is French polish. The fastest and clearest finish is clear lacquer or varnish, about three coats, without filler. If filler is used, it should be natural. If a very dark filler is used, the inlay



INLAYS WITH INSIDE CUTS are worked with a single pattern. The work is limited by the size of the inside cuts which cannot be smaller than about $\frac{1}{2}$ in. For single pieces, use the freehand method of cutting

must be protected with masking tape or by giving it a coat of shellac. If this is not done, the inlay will pick up some color from the filler and lose brilliancy. However, some types of inlays, such as Holly banding or other close-grain wood, will wipe clean with just the right amount of contrast. The use of stain on the ground work should be avoided. This positively requires masking the inlay and even then there is danger of the stain striking into the edges of the inlay and spoiling the effect.

Scored Line Aids in Sanding Work on a Disk Sander



make it readily visible. The scoring establishes a definite parting line to which you can sand more accurately than is possible when sanding to a pencil line.

Sanding work accurately to line on a disk sander is easy if you follow a stunt used by pattern makers. First the line of cut (sanding line) is scored with the point of a knife, after which a chisel-edge pencil is run in the score to

Mailing Tubes Addressed Easily On This Simple "Table"

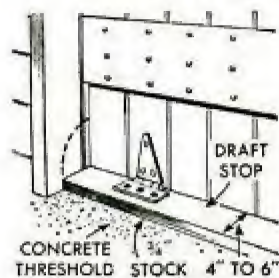


Having a number of mailing tubes to address in longhand each month, one office worker made a simple table on the top drawer of his desk to hold the tubes and support his arm to reduce wrist strain. The table is made by notching the sides of the drawer to hold a tube in position, after which an armrest is provided by laying a piece of sheet metal or hard-pressed board over the drawer as indicated, the armrest being cut out at the rear end to expose the portion of the tube to be addressed.

Loose Belt Causes Overheating

When a car is overheating, a loose fan belt which slips and will not allow the water pump to function properly often causes the trouble, although the fuel pump or some other factor may be blamed wrongly as the cause. Trimming the frayed edges of the fan belt and reinstalling it at the proper tension generally will eliminate the trouble.—Hal Gheim, Aurora, Ill.

Hinged Stop Prevents Drafts Under Large Sliding Doors



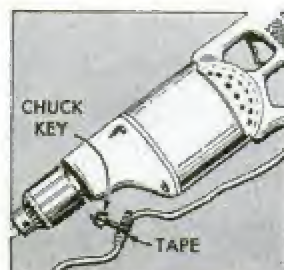
To prevent drafts and to stop rain and snow from blowing under large sliding doors on barns and outbuildings, one farmer fitted a hinged stop to the bottoms of the doors as shown.

The stop can be made of $\frac{3}{4}$ -in. stock 4 to 6 in. wide cut to fit loosely between the door jambs. Before attaching, the hinge-

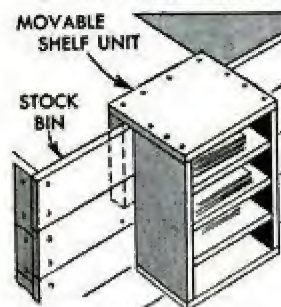
pivots are nicked with a cold chisel to stiffen them so that the stop will stay in a raised position when the door is opened.

Chuck Key Taped to Electric Cord Is Accessible for Instant Use

To avoid time lost in searching for a chuck key, which is sometimes mislaid when separated from the hand drill, one mechanic tapes it to the electric cord of the drill so that it will be always available. Attached in this manner, the key can be turned freely in the chuck merely by slacking the cord slightly.



Portable Shelf Unit Is Handy When Inventorying Stock

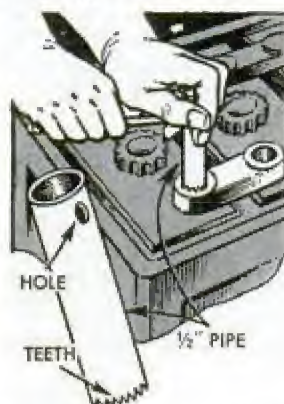


In order to have labels, envelopes, data sheets and other necessary supplies at hand when working in a stock room, one inventory clerk uses a portable shelf unit which hooks over the side of a stock bin.

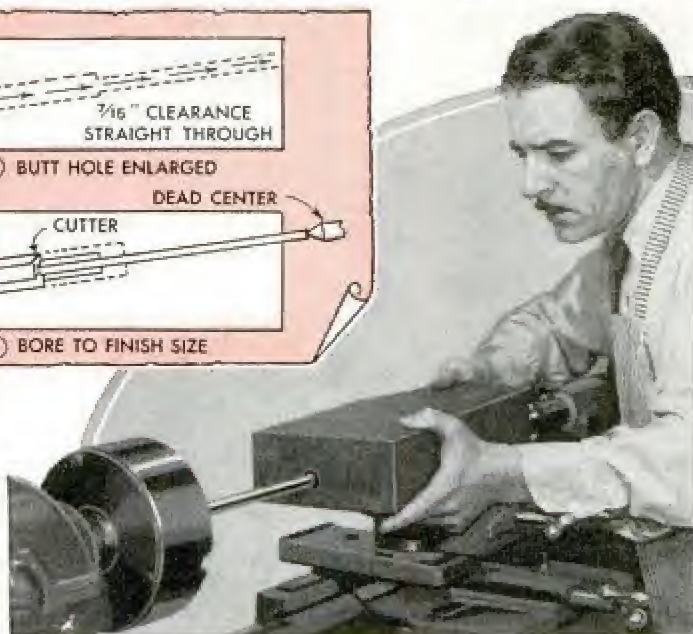
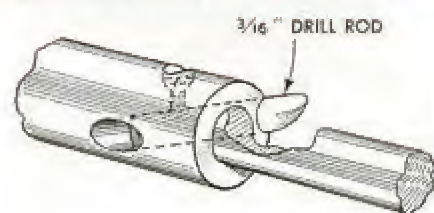
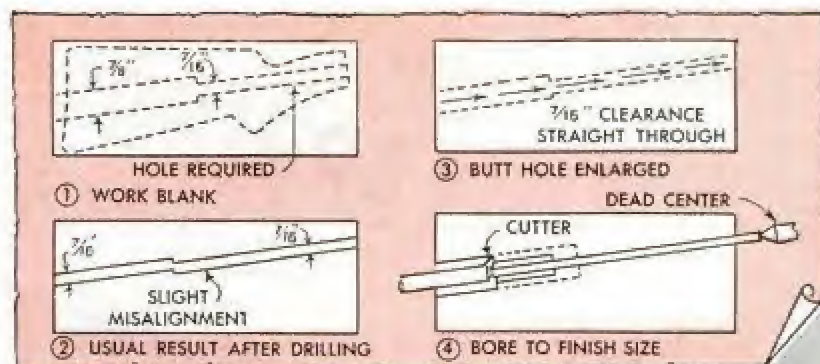
Consisting of a small box with shelves, the unit can be sanded smooth on top to serve as a writing surface.

Cutter Removes Battery Straps Without Damaging Elements

Instead of sawing off the posts to remove the connecting straps of a storage battery, use a hole saw to cut the strap from the post. To make the saw, file teeth in one end of a piece of thin wall pipe or tubing and drill a hole at the other end for a handle. To use, press the cutter down on the strap where it fits over the terminal post and turn the cutter back and forth until the ring is cut through. The straps can then be lifted off, and may be placed over the posts of a new cell and soldered tight.



Accurate Method of Boring a Shotgun Stock



When you are making a shotgun stock and want to bore the stock bolt accurately, try this method: The job requires a specially made tool—a boring bar with a pilot—but results are well worth the time taken to make it. Fig. 1 shows a typical blank and the hole required for the bolt. Follow the usual method of centering the work in the lathe, drilling from both ends. Usually the holes will be out of alignment from $\frac{1}{16}$ to $\frac{1}{8}$ in., as shown in Fig. 2. With a larger drill, bore out the butt end, Fig. 3. This will not correct the misalignment, but it will provide a straight passage for the boring-bar pilot. Do not bore the hole any larger

than necessary to clear the pilot. The final operation, which is done with the special boring bar, is shown in Fig. 4. Make the pilot end of the bar about 1 in. longer than the work, and the part behind the cutter a little longer than the depth of the hole. A piece of $\frac{3}{16}$ -in. drill rod held in place with a setscrew is the cutter, as shown in the lower detail. The boring bar is under power while the work is pushed forward by the lathe compound. Although the cut will be a little rough at the start, it will quickly smooth out and will be a perfect concentric fit at the shoulder, which is the important part.

Water-Tight Joints Made in Tubing Without Using Solder

Where pieces of tubing are to be joined in a tight seam, much time can be saved by rolling shallow grooves in the tubing with

a dull tube cutter to form rings which will interlock when the tubes are joined and hold the parts tightly. This method is especially valuable at present because it eliminates the use of solder.

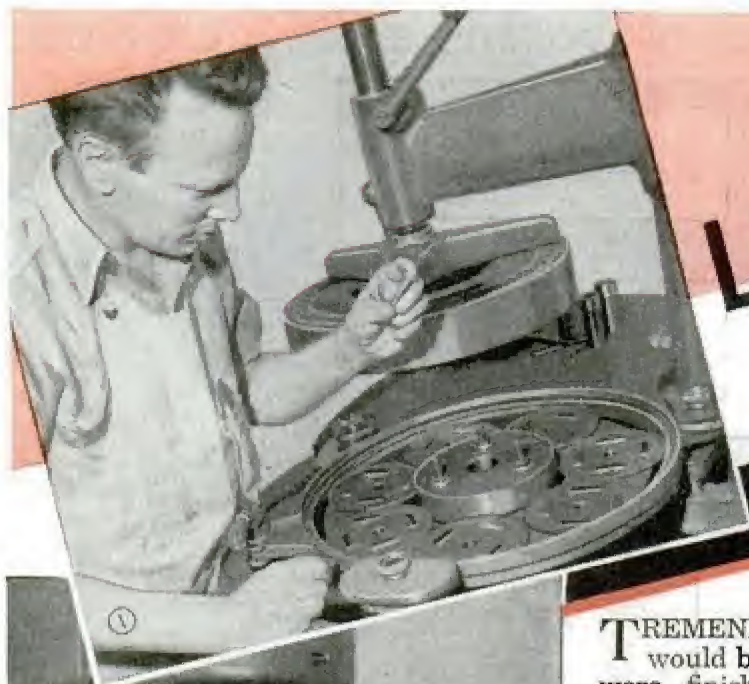
—D. H. Loosli, Chicago.



Long Life for Scrollsaw Blades

I have doubled the life of the blades on my electro-magnetic scrollsaw by using an extra table top which I cut from $\frac{1}{2}$ -in. plywood. I drilled holes in the corners of the metal table top and countersunk corresponding holes in the plywood top, leaving a small hole in the plywood for the blade. Now after I have dulled several blades I merely screw on the plywood top, which raises the work so that a new portion of each blade comes into use.

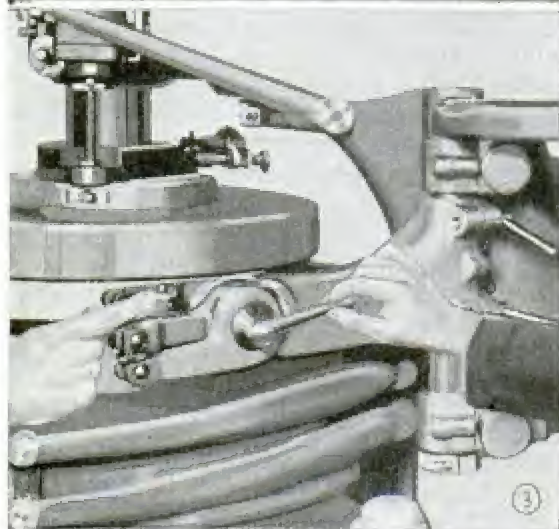
—O. A. Smith, White Plains, N. Y.



LAPPING

Gives Metal

By H. J. CHAMBERLAND

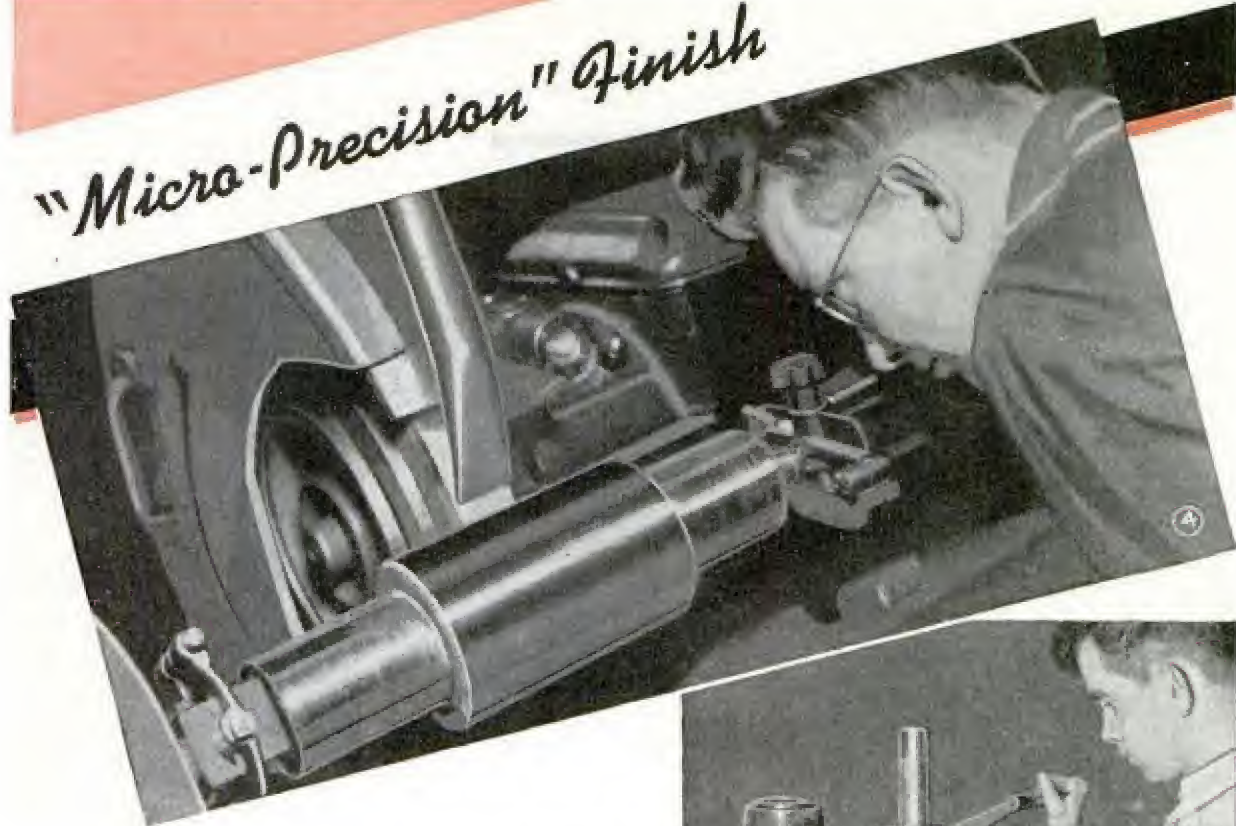


TREMENDOUS airplane speeds of today would be impossible if the motor parts were finished only with metal-cutting tools. Where accurate fit and surface-to-surface contact of moving parts are involved, as in airplane or automobile motors, the initial wear must be removed by lapping the parts to "micro-precision" dimensions before assembling them. Dimensional accuracy is impossible without surface accuracy. This article includes methods of mechanically lapping a number of similar parts for fine external finish, either cylindrical or flat.

Types of lapping machines: There are two distinct types of external lapping machines. The one shown in Figs. 1 and 5 is the original design, having two metal disks or laps the diameter of which varies to suit individual requirements. Only the bottom lap revolves and on it the parts to be finished are supported by means of retainers, spiders and other work-holding devices. The top lap, which does not rotate, does an equal share of the work and provides the necessary light pressure. This lap is made to "float" because it must be dismounted often for reconditioning. Without this floating action of the upper lap, the parts would not be finished parallel nor straight. Fig. 1 shows the lapping of gauge blocks while Fig. 5 shows the lapping of six plug gauges mounted on a retainer which allows them to rotate on their centers.

The machine shown in Fig. 2 is more modern. In this case both laps consist of fine-grit grinding wheels that rotate horizontally in opposite directions, the upper one clockwise and the lower one counter-clockwise. The upper one is lowered to contact the work, and the feed is hydraulically operated. To keep the surfaces of the wheels in perfect parallelism, a twin

"Micro-Precision" Finish



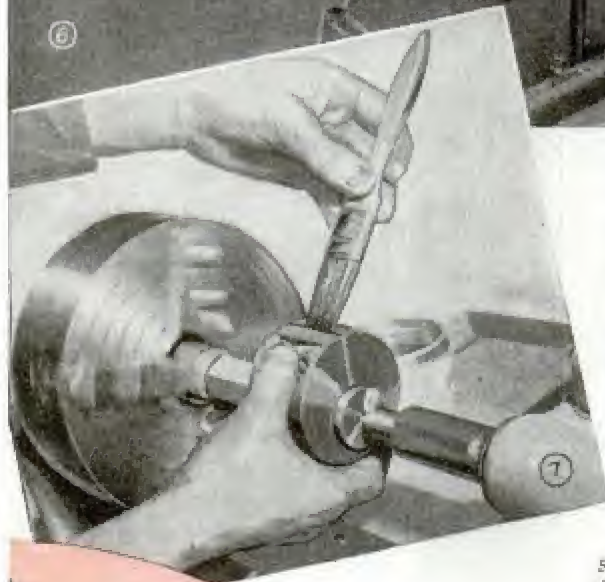
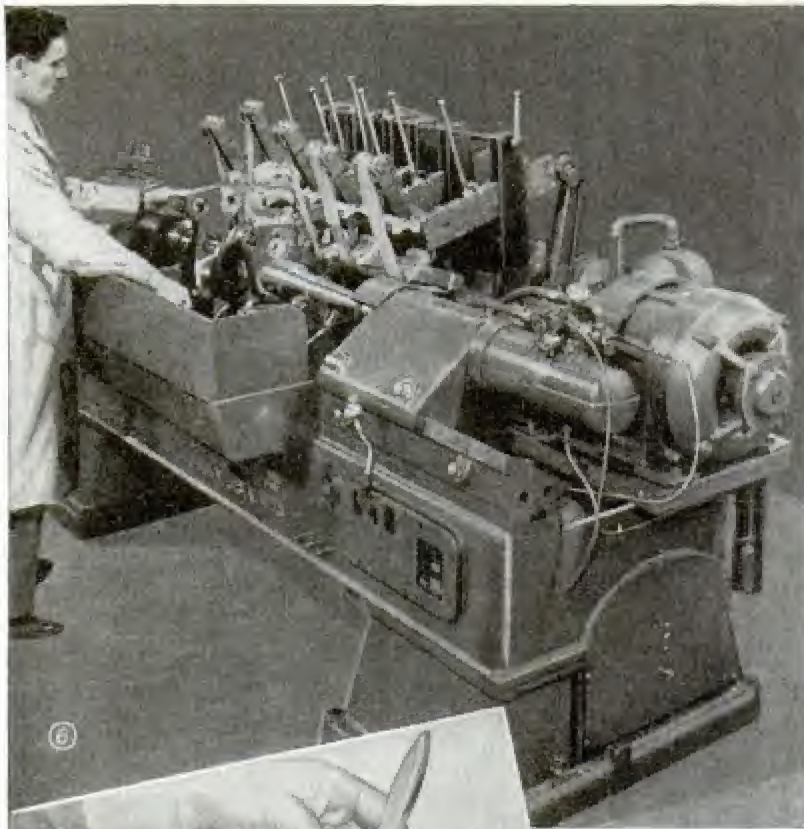
diamond dressing arm, shown in Fig. 3 is provided. This also is hydraulically controlled. With these facilities and an electrical gauge showing how the lapping operation is progressing, very little training is required to operate this machine. Besides the common types of lapping machines already described, there are some that have been specially designed for certain jobs. Fig. 6 shows such a machine which laps all bearings on a crankshaft simultaneously.

"Break-up" motion: On lapping machines a variety of work-holding devices forms the basis of the equipment. The machine itself is of relatively simple construction. The metal or grinding-wheel laps rotate at less than one-tenth of the peripheral speed of regular grinding wheels. The retainer, spider or work holder, which serves as a chuck, provides the proper travel for the work during the cycle for each piece to cover the entire abrading surface of the lapping members. The primary motion given to the work is a rolling one produced by movement of one lap with regard to the other with the work in frictional contact between them. The secondary motion is produced by the eccentric drive pin driven by a train of gears from the lower lap spindle. This single motion however, is not sufficient for a perfectly flat, parallel or straight finish. The retainer or spider is not concentric with the bottom lap but it is fixed to the spindle of the bot-



tom lap and a secondary motion for the retainer is provided by a drive pin from a train of gears assembled on the lower drive shaft. Thus during the operating cycle the movement of the retainer is somewhat similar to the throw of a crankshaft. The combined motions between the abrading surfaces of both laps provide the "break-up" action, which corrects defects to assure both surface and dimensional accuracy.

Hand lapping: As lapping machines are effective and economical for production runs only, manual lapping must be resorted to when there are just a few pieces. Fig. 7 shows an example of short-run external lapping by hand, on a lathe. One end of a go-and-no-go plug gauge, which is being

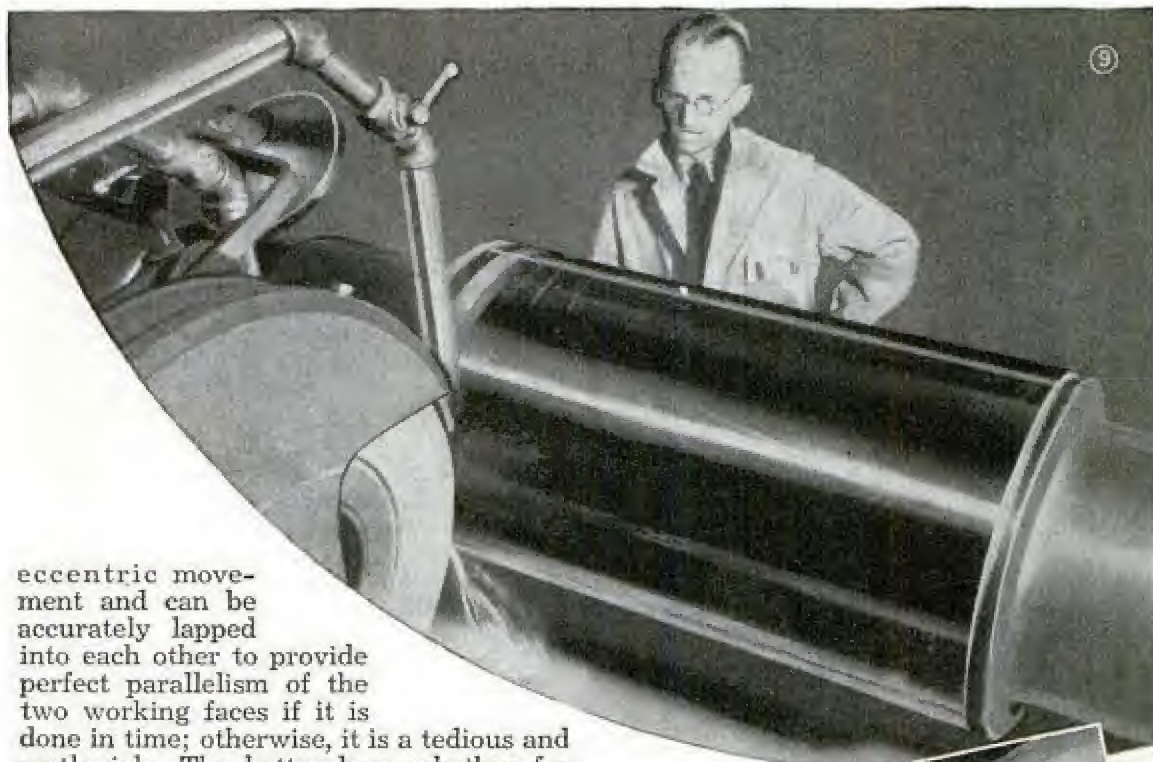


lapped in this case, is held in a three-jaw chuck and the other end is centered on the tailstock. The working surface of the lap is bored eccentric to provide space for two socket-type screws which are used for adjustment. The lap is slit after the holes have been tapped. The lap shown in Fig. 8 consists of a piece of slit tubing and lapping pressure is provided by a lathe dog. For flat lapping manually, one must still resort to a lapping plate as shown in Fig. 10.

Rolling axis and transposition: Cylindrical lapping is done on wrist pins, valve stems, tappet rollers, roller bearings and other similar parts. In the construction of retainers for cylindrical parts, the rolling axis of

the work is not in line or radial with that of the laps. For free rolling action, the work must be positioned at the greatest angle possible, which varies from 10 to 22 degrees, depending on the nature of the work. This angular position of the work is necessary to introduce a slippage as the work is rolled on the face of the laps. Mechanical flat lapping requires a particular technique, called transposition, to assure precision of parallelism. After some lapping has been done, the machine is stopped and the parts are exchanged with the corresponding parts diametrically opposite them for the next lapping cycle.

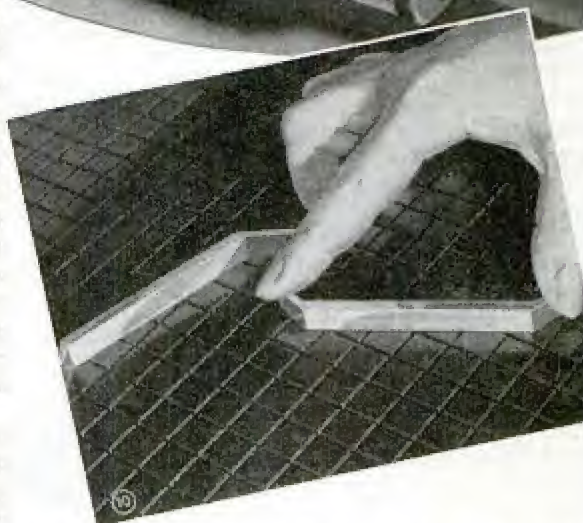
Metal laps and lapping compounds: Fine-grit lapping wheels introduce no maintenance problems as they remain permanently located and automatically wear themselves down uniformly, from repeated dressings and surface-to-surface contact. However, the face of metal laps must be reconditioned regularly. Preparation of the surface to be flat-lapped is highly important; it must be machined accurately, the part must be stabilized by heating and freezing alternately several times to eliminate internal strains, and the surface to be lapped is finally hand-scraped. Two surfaces of square or rectangular shape are made precisely flat by lapping them into each other with reciprocal movement. Disk laps are finished similarly by circular or



eccentric movement and can be accurately lapped into each other to provide perfect parallelism of the two working faces if it is done in time; otherwise, it is a tedious and costly job. The better laps, whether for machine or bench work, are made from castings of soft and close-grain gray iron, which must be free from alloy. The softer and finer the grain, the better will be the surface of the laps and the quality of work they will do. On lapping machines, it has been found economical to make the laps interchangeable so that they can be transposed each time they are removed for resurfacing. This practice is said to help the surfaces wear more evenly and thus prevent a concave-convex condition, which cannot be remedied simply by lapping.

Proper selection and use of lapping compound is highly important. The abrasive grain should mix well with the vehicle or lubricant so that the mixture will adhere readily to the surface of the laps. Fine silicon carbide of 400 or 500-grain size is excellent for general lapping requirements. Rouge and lavigated alumina are particularly recommended for extra fine finishes. Kerosene, with a little machine oil added, makes a fine vehicle for the grain, but sperm oil has no equal and olive oil is a close second. The excessive use of the compound is worse than using too little. The compound should be spread uniformly but sparingly on the entire surface of the still member and then lapping should be carried on for 2 min., after which both surfaces should be cleaned with naphtha and wiped dry.

Mirror-like finishes: External lapping includes finishes produced by fine grinding. What correct grinding technique can do is shown in Figs. 4 and 9, which show



lapped finishes on rolls such as used in sheet-metal rolling mills and also in textile and paper mills. This kind of work requires the use of several wheels varying in grit size. As the diameter of the roll increases, the diameter of the wheel should decrease in order to obtain a small arc of contact between the wheel and the work. To obtain mirror-like finishes, four different wheels are used generally on hardened steel rolls. A 46-L5B is used first for roughing off the greatest amount of stock. It is followed with a 150-J5B for a second roughing cut. Both wheels are vitrified aluminum oxide. Then the rolls are finish-ground with a silicon-carbide shellac-bonded wheel, 320-I8L. The fourth wheel, also of silicon carbide, 500L9L, removes no stock but imparts the mirror-like finish.

The choice of coolant in connection with



the bonded abrasive laps and roll grinding is important and so are the means of filtration. The most efficient solution for lapping consists of just enough soap in water to produce a light but not a heavy suds. For the ground reflective finish, a solution consisting of a good grade of soluble oil gives good results and even sal soda can be used. The use of a dirty coolant has most serious effects and therefore the abrasive and metallic particles must be removed systematically. Many filtering devices have been tried but the most effective is centrifugal clarification. In large plants all lapping operations are performed in air-conditioned rooms.

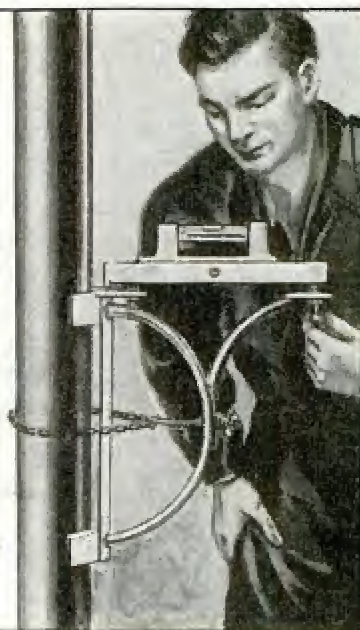
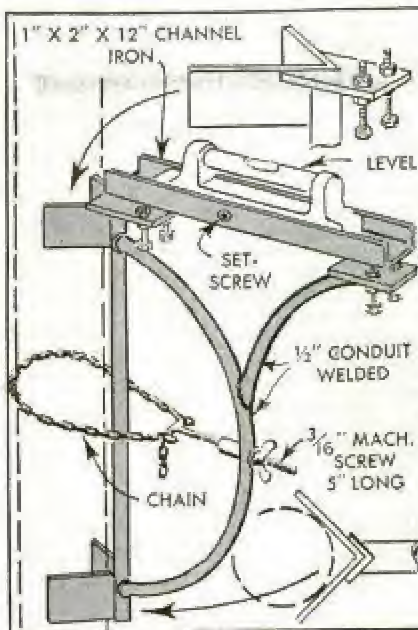
Measuring surface finish with light waves: The apparatus shown in Figs. 11 and 12, consisting of a monochromatic (one-color) light and two optical flats, is a natural micrometer to measure accuracy of flatness by means of light waves. The surface to be inspected should have an accuracy of at least fifty-millionths inch. Fig. 12 shows the finish of a plug gauge being checked against that of a precision gauge block. Light waves have crests and troughs which usually equal each other and a wave length is measured from where it begins to where it begins to repeat itself. The length

of the wave remains constant but its width varies with the intensity of the light. With incandescent helium, used in this case, the light wave has a length of 23.2 millionths inch. When the waves cross each other they blank each other out at the point of crossing. The blank spots are called black interference bands and they occur at every wave length or every 11.6 millionths inch. When the light is turned on the work, the waves are reflected from the top surfaces of the parts and the bottom surface of the top optical flat. The waves are produced by a wedge of air between the two, and the width of the air wedge determines the spacing of the bands. These always run at right angles to the wedge of air. So, what the observer sees are the two patterns shown in Fig. 13. The surface at the left is flat within four-millionths inch because the dark bands are all parallel to the edge of contact. The surface at the right is not nearly as flat because the dark bands curve; the more the curvature the greater is the inaccuracy of the surface finish.



Level Saves Time in Plumbing Vertical Shafts

Used in a large ordinance plant to plumb hundreds of vertical shafts, this level saved time and assured accuracy. Once it is attached to the shaft by means of a snubbing chain, which takes only a few seconds, the level can be swung around the shaft to check it quickly in all directions. Another advantage is that it permits use of a graduated vial instead of having to depend on a tiny ungraduated one. The frame is welded together and is assembled from conduit, angle and channel iron as shown. The two large V-shaped pieces, which contact the shaft to be plumbed, are tied together with a piece of small angle iron $13\frac{1}{2}$ in. long to give the frame rigidity, the two curved pieces of the frame being conduit bent to shape and welded in place. Two iron plates welded to the top of the frame are provided with adjusting screws which support



the channel-iron level holder and permit the level to be adjusted to a true right angle with the V-shaped contact pieces. Once the adjustment is obtained it is only necessary to check occasionally to see that a true right angle is maintained.

—V. C. Lovegreen, St. Paul, Minn.

Altering a Ruler to Make Dot-Dash Lines on Drawings

To add a neat and precise touch to your drawings, convert your regular brass-edged ruler into a dot-and-dash ruler by removing the brass strip, sawing a flat section along the edge of the ruler from which

the strip has been taken and grinding the brass strip so that it has two projecting points every $\frac{1}{2}$ in. as shown. Next drill countersunk holes in the brass strip and nail it to the edge of the ruler, making sure that the nails do not project, since they would interfere with the stroke of the pen, which is fitted with a small heart-shaped metal piece, soldered at a slight angle to contact the points on the brass strip.



Cover Protects Gas Tank Lock

Dirt and moisture are less apt to enter the lock on a gasoline tank cap if it is kept covered with a small Cellophane or wax-paper cup of the type sold in most stores to protect food in the refrigerator.

—Spencer A. Pease, Wauwatosa, Wis.

CASH FOR UNUSUAL IDEAS

If you have an idea that might be used for a short article in these pages, send it to the Home-craft Editor. Enclose a snapshot or drawing and give all the necessary information in as few words as possible. To be accepted, material must be of general interest and different from any we have published previously.

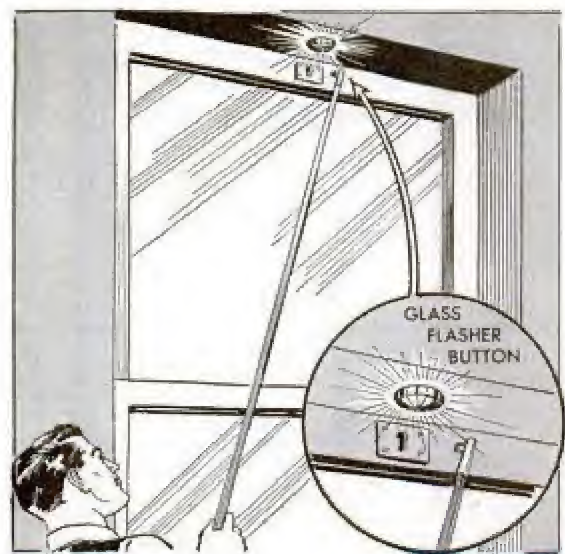
Panels in Front of Poultry Roosts Keep Chickens Out of Litter



Instead of installing dropping boards under chicken roosts in the usual way, one farmer eliminates the boards and puts panels of hard-pressed board in front of the roosts as shown. This makes it easy to clean under the roosts and keeps the chickens from scratching the litter over the poultry-house floor.

Flasher Button Locates Socket In Upper Sash of Window

In lowering the upper sash of a high window in a school or office, the glass often is cracked in trying to locate the pull socket



with the long window hook. If a glass reflector or flasher button is attached to the window casing directly above the socket, it will be easy to insert the hook of the pull pole into the socket.

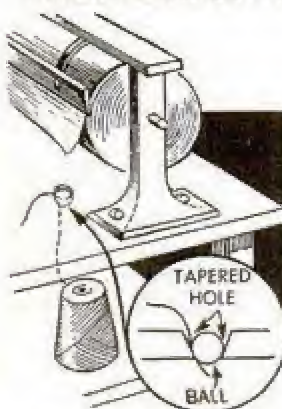
Clothespin Serves as Clamp To Hold Test Tube

An ordinary spring-type clothespin is just the thing for holding test tubes up to $\frac{1}{2}$ in. in diameter. The curved recess cut in the inner surfaces of the jaws for gripping the clothesline are just right for fitting around the test tube. For tubes larger than $\frac{1}{2}$ in. in diameter, it may be necessary to enlarge the recesses.

—Herman Klein, Pittsburgh, Pa.



Ball Bearing in a Tapered Hole Holds End of Wrapping Twine

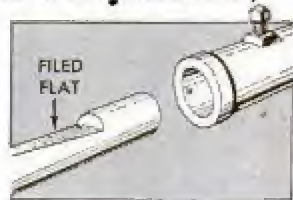


To prevent the loose end of wrapping twine from tangling, and yet have it at hand for instant use without an overhead fixture, run it through a small hole in the counter. Taper the hole from the top so that a ball bearing will fit snugly into it. The ball will

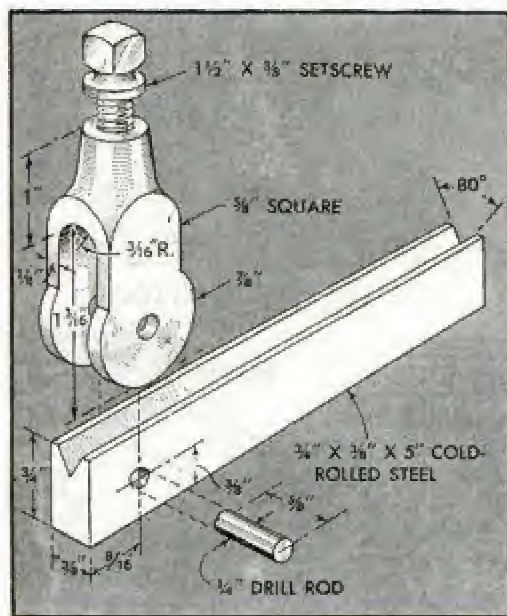
prevent the twine from falling back through the hole and will allow the twine to be pulled up as needed.

Setscrew Prevents Loss of Parts If They Loosen on Machinery

Adjustable parts of farm machinery and other equipment which are held in place with setscrews often work loose and are lost. To prevent this, file a tapering flat on the removable part, leaving a shoulder as shown. The setscrew tightens on the flattened portion. Should the setscrew loosen, the part cannot drop entirely free of the holder.



Holder Supports Boring Tool Close to Work



For boring and threading work of small internal diameter, this boring tool holder, made from scrap steel, will prove a worthwhile addition to your lathe equipment. To slot the yoke, drill a hole near the center and make two saw cuts down to it from one end. Then the slot is brought to finish



size and the circular part rounded by hand filing. A hole is drilled through the slot to take a piece of 1/4-in. drill rod, which holds the yoke to the shank. The tapered end is turned to size and, while the yoke is still in the chuck, the hole for the setscrew is drilled and tapped. An ordinary setscrew can be used, or you can make up one to fit. The shank of the holder is grooved in a shaper to hold the boring tool, and a hole is drilled in one end for the drill rod, which is a press fit.

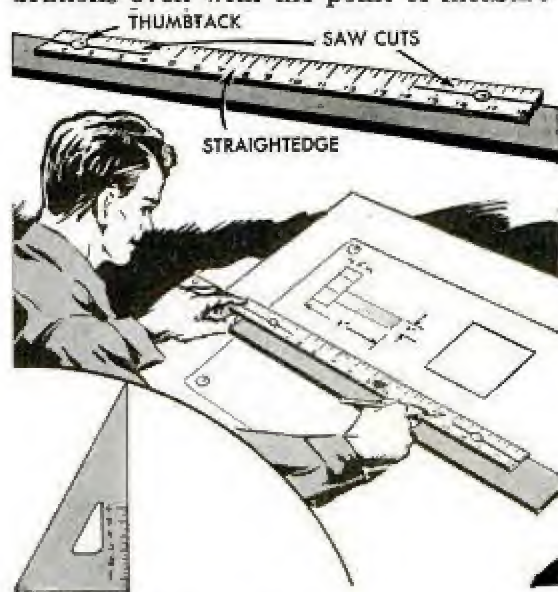
—C. W. Woodson, East Aurora, N. Y.

Sliding Ruler on T-Square Permits Quick Measurements

An 18-in. straightedge with slots cut at each end through which thumbtacks fasten it to the T-square, will enable you to make horizontal measurements anywhere on the board without sliding the T-square out of the way. The slots allow moving the straightedge to either side to bring the calibrations even with the point of measure-

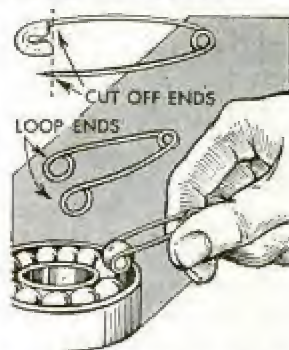
ment. Also, by calibrating a 60-degree triangle along its 90-degree edge, you can measure vertically without removing the triangle from the square.

—Jack N. Gunter, High Point, N. C.



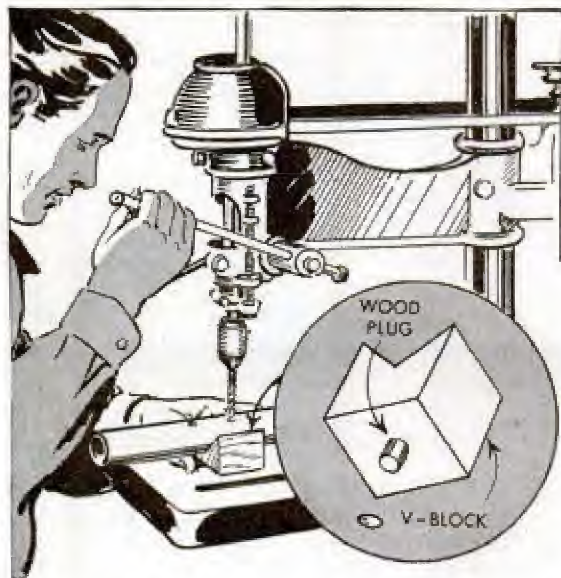
Ball Bearings Easy to Handle With Improvised Tweezers

When taking small bearings apart, a pair of tweezers like the ones shown will simplify handling the small balls. The tweezers can be made from a medium size safety pin by cutting off the head and pointed end and forming small eyes on them, the size of the eyes depending on the size of the bearings.



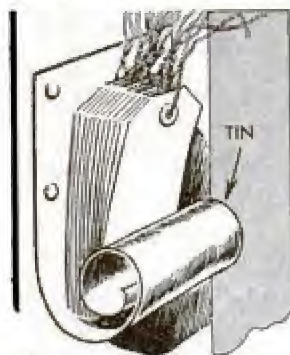
Corrosive action on battery boxes, cables and terminals can be avoided by coating them with battery pitch dissolved in a small amount of gasoline.

Tenon on V-Block Centers Work On Drill-Press Table



When drilling duplicate pieces of round work, this V-block will automatically center the work under the drill, once the table is adjusted correctly for the job. The block is made of wood and has a tenon or plug on the underside to fit snugly in the center hole of the drill-press table. Thus when the block is in place the work will be centered under the drill when placed in the block.

Adjustable Shipping-Tag Holder



Nailed to a wall or table within easy reach, this simple holder will permit rapid removal of one or more shipping tags without disturbing those remaining in the holder. It is made by simply rolling one end of a piece

of tin or light sheet metal so that the tags can be slipped behind the rolled section.

Adjusting Tappets More Easily

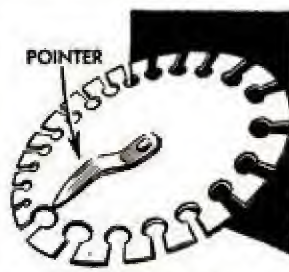
You can save considerable trouble in removing the engine head and making adjustments on the tappets of your car simply by unscrewing the spark plugs from the engine head and then reconnecting them to the proper leads from the distributor. Turn on the ignition and crank the engine slowly by hand. When a spark plug "fires," that indicates that the piston of the corresponding cylinder is in the firing posi-

tion. Leave the crank in approximately the same position as when the spark plug fired and make the necessary adjustments on the tappets of the "firing" cylinder. After you have adjusted all the tappets in this manner and bolted the valve plates back on, simply screw the spark plugs back into the engine head and reconnect the leads from the distributor.

—R. H. Brown, Wellesley Hills, Mass.

Spring Indicator on Wire Gauge Helps to Avoid Errors

When using a wire gauge to make duplicate measurements, any possibility of error in using the wrong slot in the gauge can be avoided by using an adjustable



pointer like this one. It is made from a piece of clock spring and is pivoted to the center of the gauge by means of a small rivet, making the pivot a fairly snug fit so that the position of the pointer cannot be changed accidentally when laying down the gauge or by brushing it against your clothing.

Shields From Discarded Linoleum Keep Mice Out of Seed Corn

To protect seed corn strung on wires in the barn for drying, one farmer uses shields made from discarded linoleum. These pieces, about 8 by 12 in. in size, were slit through the center to the depth of 7 in. or more so that they could be slipped over the line, as shown.

—G. E. Hendrickson, Argyle, Wis.





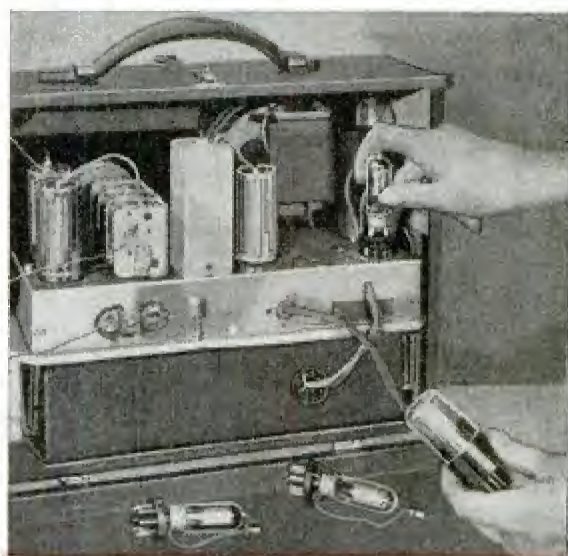
Tube Substitutions for Battery Portables

By ROBERT OELRICH

IF YOUR battery portable receiver is temporarily laid up because you are unable to purchase a 1A7-GT, 1N5-GT, or a 1Q5-GT tube, you can substitute miniature type tubes such as the 1R5, 1T4 and 1S4 which are easier to find.

Although these miniature-type tubes are of different base design and require a tiny socket, there is nothing difficult about assembling an adaptor by means of which the substitution may be made without any changes in the wiring of the set.

A miniature-type socket is wired to the base of a discarded metal type tube as illustrated. The base of a metal tube, such as a 6F6, 6K7 or similar type, is removed by straightening the crimped edges of the outside shell and unsoldering the wires in the pins. This base is then used as the male end of the adaptor. Solder 4-in. lengths of No. 18 bare solid copper wire to each pin terminal of the miniature tube socket according to the accompanying chart specifications; all pin numbers refer to bottom view. Thread the leads on the miniature tube socket through the empty pins of the base and pull the wires through the base evenly so that the miniature tube socket stands level and rigid just above the base, and solder the wires in the base pins. Spread the miniature socket prongs slightly to make the compact adaptor unit shown in the photos. Make certain that none of the wires in the adaptor are touching each other; insulate if necessary. Where a grid cap must be provided, bring out a fairly stiff 3¼-in. insulated lead from the grid pin terminal on the miniature tube socket. The grid cap is then removed from the old GT tube and soldered to the end of the grid lead. GT tubes 1C5, 1A5, 1Q5 and 1T5 may be substituted indiscriminately without adaptors if the set uses a 1½-volt "A" battery.



Substitute	Type	Substitute	Type	Substitute	Type
1R5	1A7GT	1T4	1N5	1S4	1Q5
Pin No. 1 7		Pin No. 1 2		Pin No. 1 7	
2 3		2 3		2 3	
3 6		3 4		3 5	
4 5		4 N. C.		4 4	
5 N. C.		5 N. C.		5 N. C.	
6 - Grid Cap		6 - Grid Cap		6 N. C.	
7 2		7 7		7 2	

DESK LAMP

By S. A. Johnson

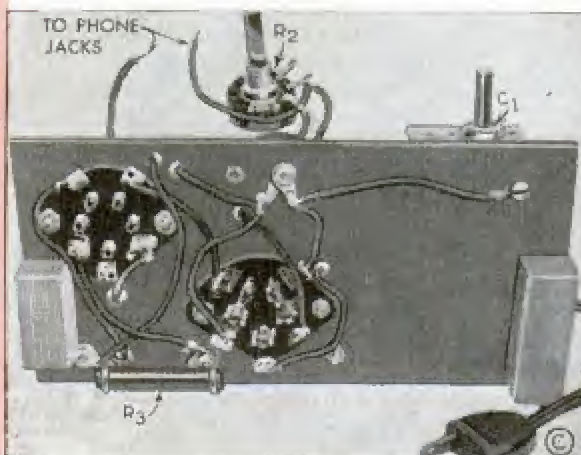
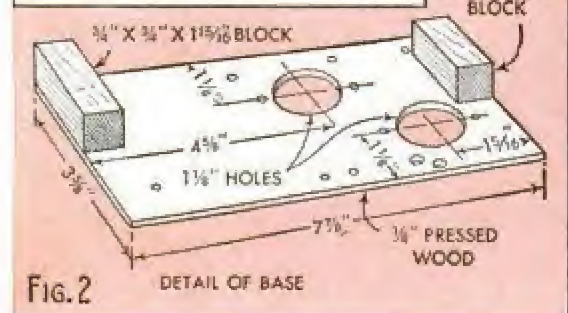
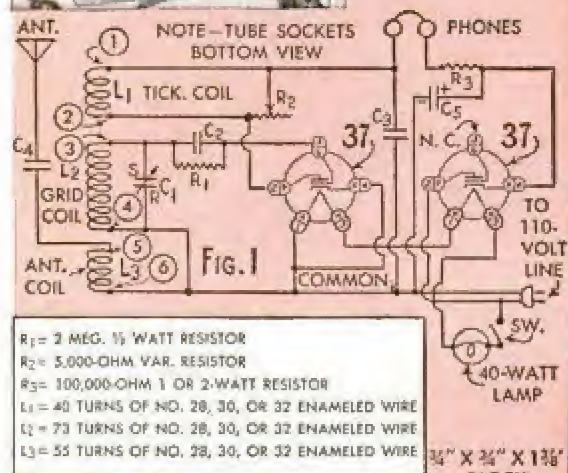
BBUILT into a wood card-filing case, this simple 2-tube student set also serves as a desk light, as the 40-watt lamp bulb is part of the radio circuit. No batteries are required as the lamp bulb drops the line voltage for the tubes and the set works on any 110-volt a.c. or d.c. supply line.

This ultra simple broadcast receiver employs two type-37 tubes which are a common older type usually found in old sets, or a radio student's junk box. One is used as a detector and the other for a rectifier as shown in the schematic circuit diagram Fig. 1; type-76 tubes may be substituted without change. The file box which serves as a cabinet for the set, is a standard type designed for 5 by 8-in. cards. Assembled on a 1/8-in. hard-pressed wood base the

chassis is supported by two small blocks of wood resting on the bottom of the case. All base and case details are clearly shown in Fig. 2, and photos A, B, C, D and E.

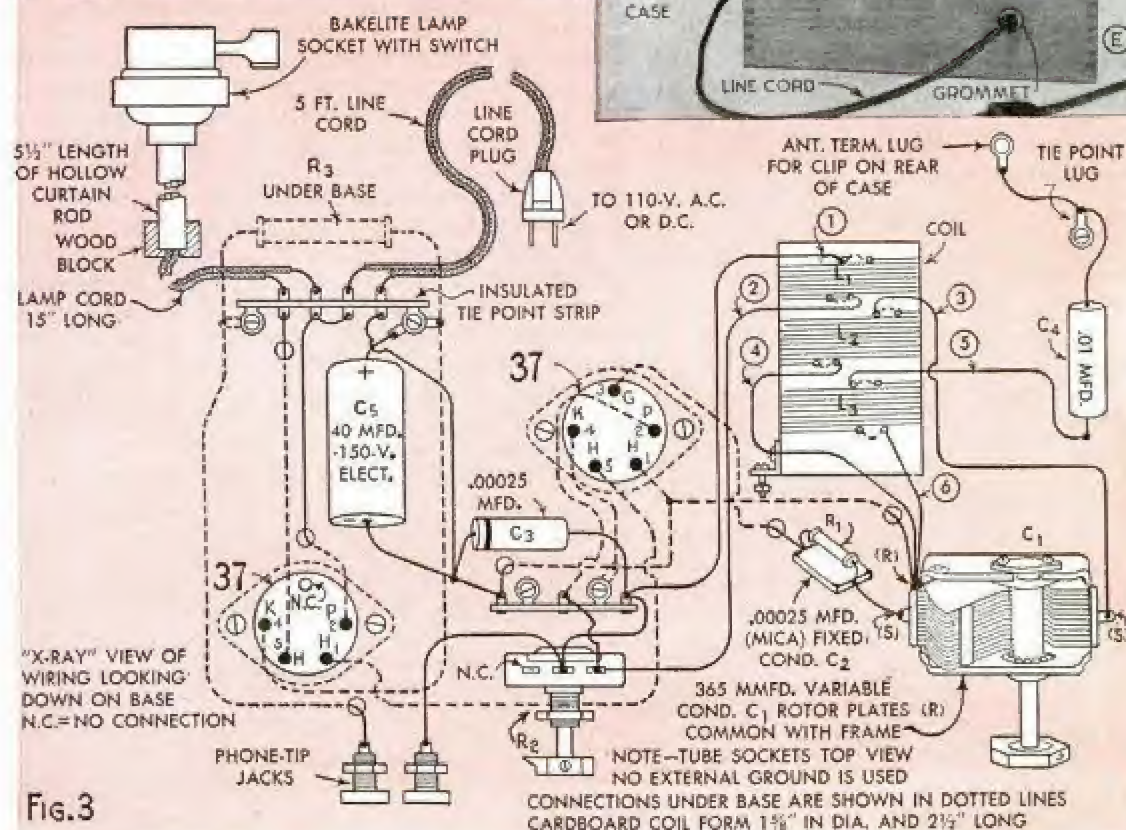
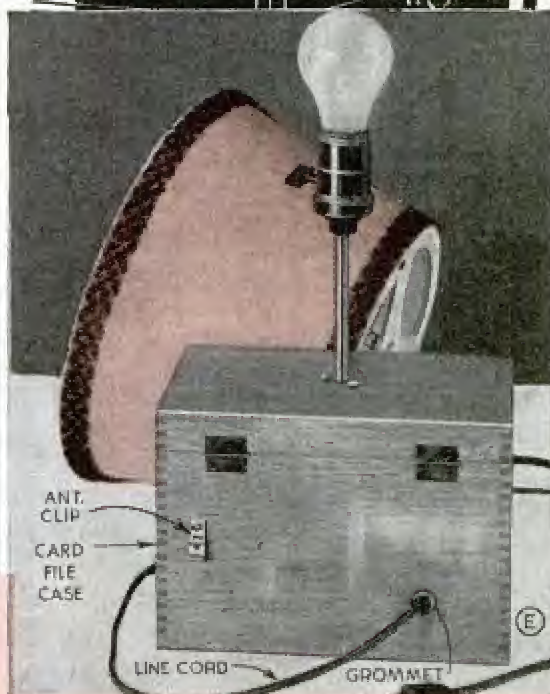
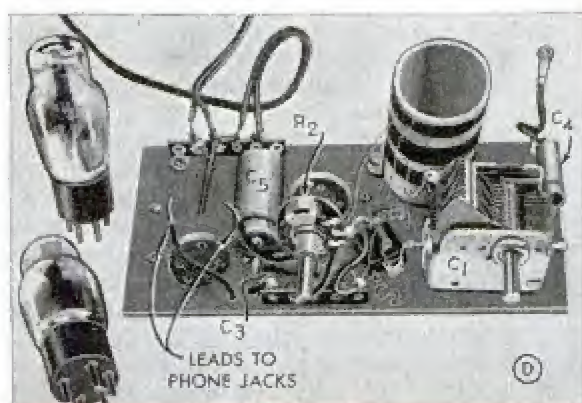
The coil is hand wound clockwise on a cardboard tube and the windings are spaced 1/4 in. apart. Suitable wire can be obtained from any old filter choke or audio transformer. The coil is fitted with a small angle bracket for mounting as will be noted in the simplified wiring diagram Fig. 3. All of the circuit wiring is completed before the chassis base is installed in the file box.

The light socket, which is a Bakelite variety commonly found in the "dime" store, supports the bulb and shade and is mounted on a 5 1/2-in. length of hollow round curtain rod. This rod is simply forced into the bottom of the lamp socket, and the other end is mounted on the case in a 3/4 by 1 3/4 by 1 3/4-in. wood block, drilled and fastened to the underside of the box lid by means of two wood screws. China cement keeps the rod from sliding down into the box. The antenna connection is made to a



"DX-ER" FOR BOY'S ROOM

Fahnestock clip mounted directly on the rear of the case by means of a soldering lug and a machine screw. Detailed student material list R-328 is available from Popular Mechanics radio department, upon receipt of postage. The lamp shade is an inexpensive type which has a spring clip that clamps over the light bulb. Best selectivity on local stations in crowded localities is obtained by using a 15 ft. indoor antenna. A long and high outdoor antenna is best for "DX" stations. No external ground is used on this set. The receiver is turned on and off by means of the line switch on the lamp socket.



"CAMERA" TUBE for Television

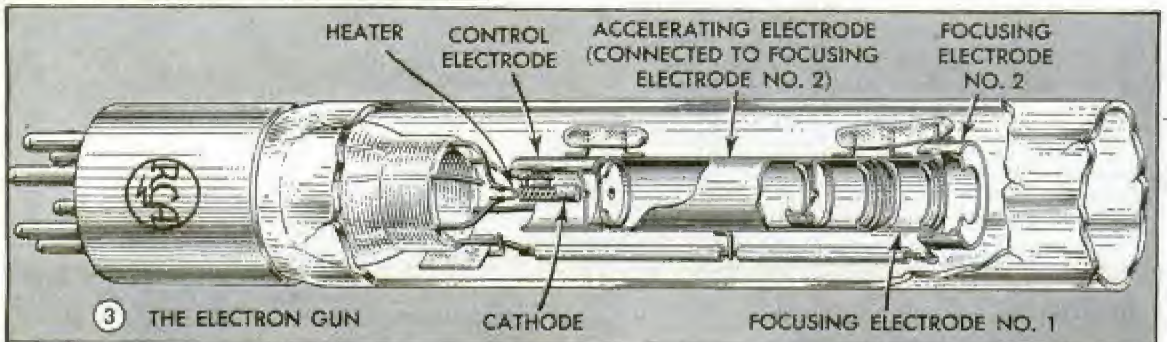
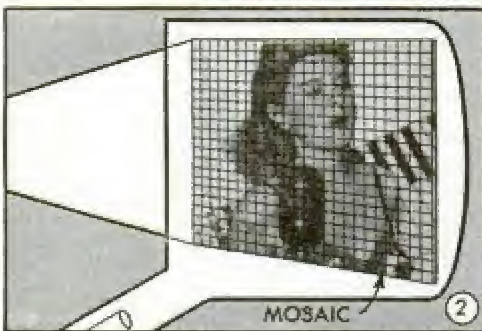
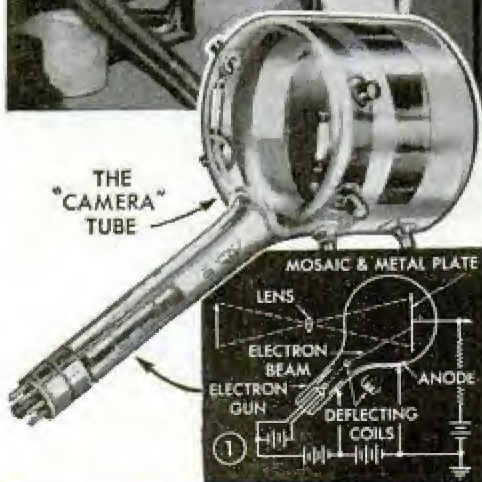
By F. L. Brittin

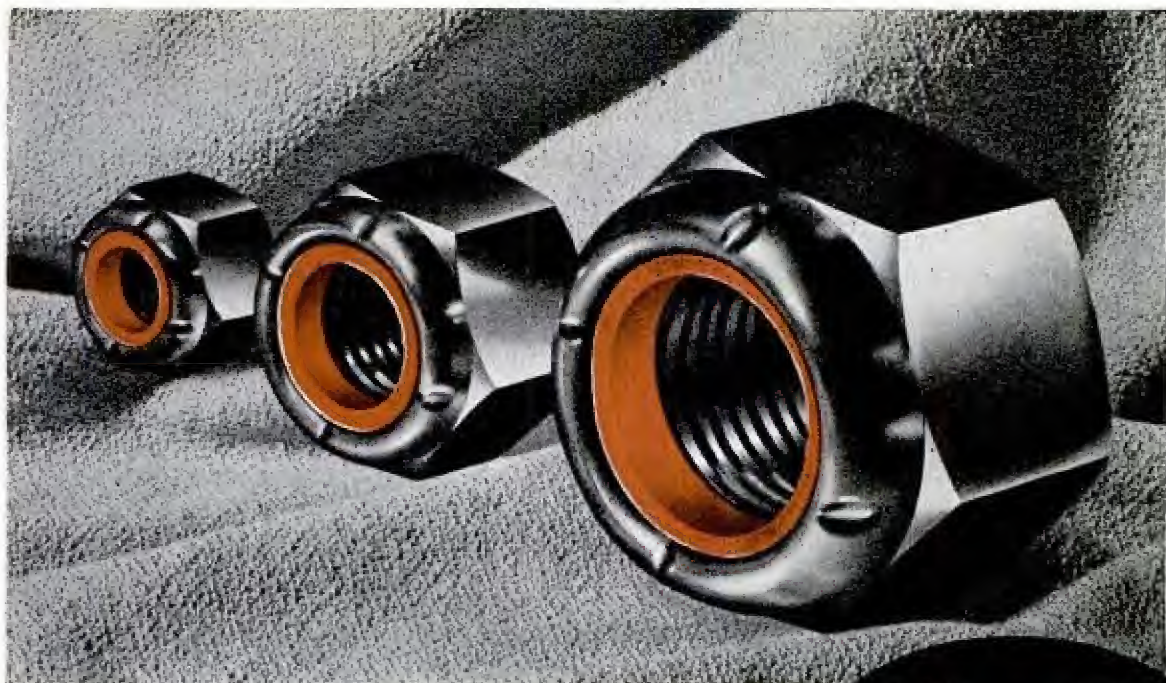
PICKING up the scene and converting it into an electrical signal, the electromagnetic deflection type Iconoscope "camera" tube is a special cathode-ray tube that makes modern television transmission practical. As in many advanced developments in sight and sound engineering the inventor makes good use of tips provided by nature, and in this case the eyes have it. The "camera" tube "looks" at individual points on the object at different intervals of time and the impulse received from each point is transmitted separately.

The tube contains a mosaic plate covered with miniature photoelectric cells. These individual cells consist of cesium-oxide-coated silver particles that are deposited on a mica sheet which is mounted on a metal plate. Each tiny particle, mica dielectric and the metal plate, form a miniature condenser. When this mosaic plate is mounted in the vacuum tube these tiny condensers are charged by the photoelectric effect when the tube is connected in

the pickup "camera" as shown in the conventional circuit diagram Fig. 1. Pictorially exaggerated in Fig. 2, these individual cells are charged in varying degree according to the amount of light picked up by the mosaic elements; these are discharged by the vertically and horizontally controlled sweeping beam from the electron gun, through the resistor, thus producing a signal. Each cell recharges instantly. A view of the electron gun assembly appears in Fig. 3. A good television picture may consist of 240 lines of top to bottom "looks" at the object repeated 20 times per second. For example, to form a single 3 by 4 in. picture the television "camera" would have to look at this young lady in about 76,000 spots.

As the result of photoemission and secondary emission from the mosaic, the tube generates a current which is proportional to the image brightness of the particular spot being scanned at any instant. The flow of this current through the load impedance produces a voltage which is the video signal for the television picture. Video will be a commonly used postwar word which identifies the television picture signal.





WHAT'S A NUT FOR?

A nut is an important type of fastening.

It draws things together. It holds them. It is removable and replaceable.

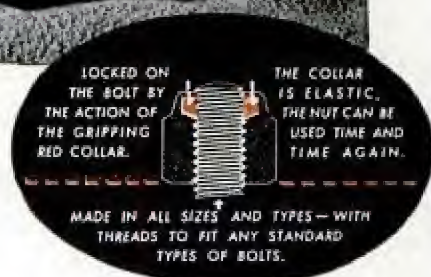
But its chief job is to hold. If it ever loosens and lets go, it's not a good nut.

An Elastic Stop Nut always stays put. It grips fast without extra locking pins or gadgets. It locks anywhere on the bolt. And even severe vibration won't break its hold. Until you want to take it off it's on for good.

The reason is the elastic collar in the top. This collar squeezes between and around the bolt threads. It hugs them with an unyielding grip. Since it is elastic you can use the nut over and over again.

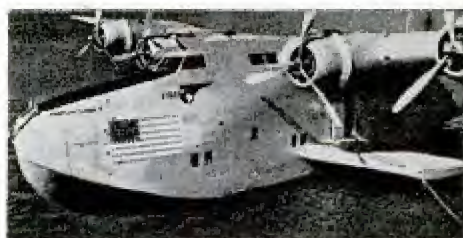
Today Elastic Stop Nuts are used by billions in building airplanes. A single bomber uses more than 50,000. That is because they are so secure and safe. After a while you'll see these Esna nuts on many of the things you buy. You can tell them by their red collar.

And you'll know that the car, refrigerator, radio or whatever it is, will be safer, last longer, and need less service.



OK'D FOR THE RESPONSIBLE JOBS

When Pan American's great Boeing Clippers come home, they get a thorough going over. A swarm of skilled mechanics in 8-hour shifts have the Clipper ready to go again in 60 hours. The many thousands of Elastic Stop Nuts that fasten these ships cut inspection and servicing time and contribute greatly to their quick "turn-around."



ESNA

TRADE MARK OF
ELASTIC STOP NUT CORPORATION OF AMERICA

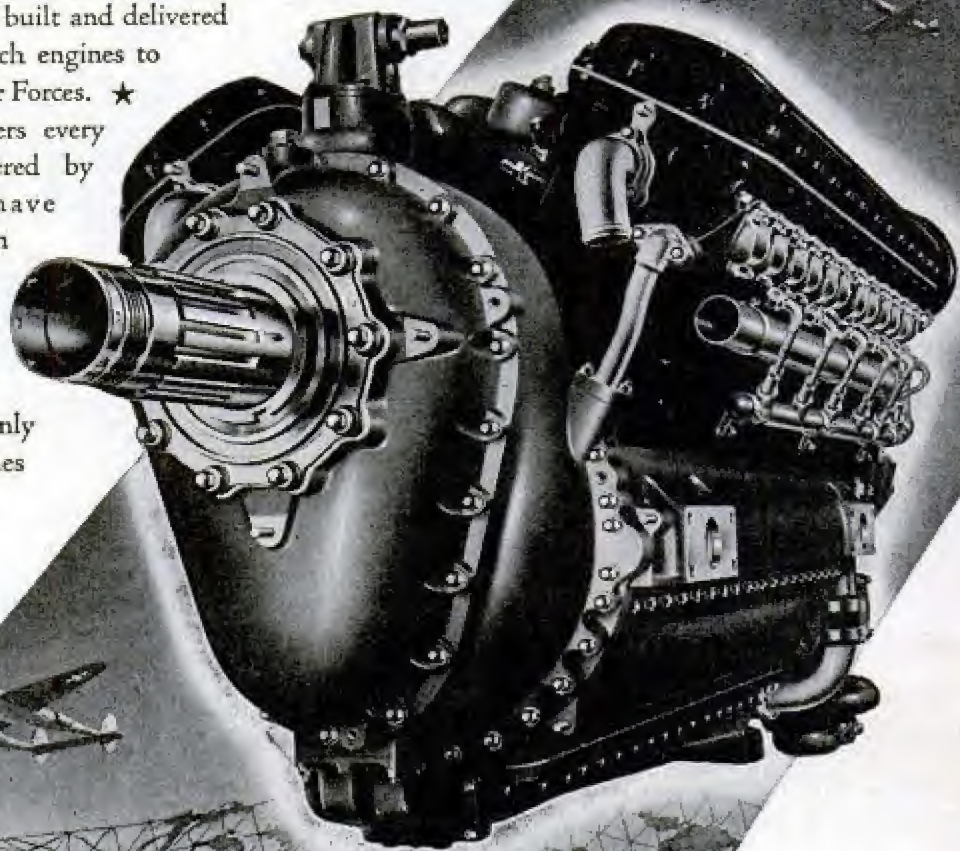
ELASTIC STOP NUTS

Lock fast to make things last

UNION, NEW JERSEY AND LINCOLN, NEBRASKA

THEY MUST BE GOOD

The battle record of American fighter pilots plainly says, "They must be good!" ★ Here at home, our firm resolve is that the engines we supply them must be good too — the best that care and precision and long experience can produce. Allison has built and delivered more than 50,000 such engines to the U. S. Army Air Forces. ★ In service that covers every front, planes powered by these engines have helped to run up an impressive score against enemy aircraft. ★ This is an indication of qualities useful not only in war but in engines to power the planes in which you will travel when peace has been won.



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P-39—Airacobra
P-40—Warhawk
A-36 and P-51—Mustang
P-63—KINGCobra

More than 50,000 Allison engines built for the U. S. Army Air Forces power the above planes.

**KEEP AMERICA STRONG
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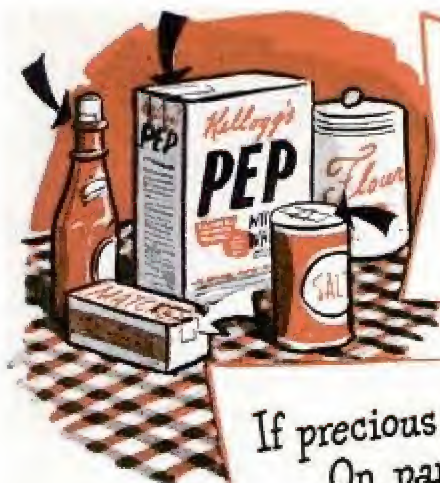
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Allison

DIVISION OF
Indianapolis, Indiana



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Must be wrapped securely;
But Texcel Tape will seal them all,
Quickly, neatly, surely!

If precious stockings should get caught
On parts of desks or chairs,
Just shield rough spots with Texcel Tape—
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For Texcel is an improved tape
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"How do you mix your paints?" inquired an admirer of the work of a famous painter. "With brains," was the crisp reply.

The combination of "know how" and good tools is an equally effective formula for shop work. His years of experience have enabled the veteran machinist pictured here to recognize the best in files—and to "weed out" the inferior ones. For the exacting work he is doing, he uses Nicholson brands. His production is high, his work precise, his rejects few.

Nicholson Files will aid any mechanic's skill. Precision-shaped, precision-cut, precision-hardened, these world-famous files come through the factory in such uniformly high quality that Nicholson can safely guarantee *Twelve perfect files in every dozen.*

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48 interesting illustrated pages on the manufacture, kinds, use and care of files.

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Television After V-Day

Continued from page 87

Problems of cost will solve themselves when television goes commercial. National chains will make possible high-grade programs; television may go into the movie theaters; department stores are already planning to put style shows and store scenes on home screens to lure housewives away from the kitchen sink.

An expensive problem remains: the transmission of FM sound and television image beyond the horizon. The short waves don't follow the earth's curve. A nationwide hookup involves transmission from city to city by coaxial cable or by radio relays. Either method is costly. The American Telephone and Telegraph Company considers as a definite possibility the investment of up to \$100,000,000 in construction of 6,000 to 7,000 miles of coaxial cables which could carry television images as well as hundreds of telephone conversations. Even that mileage would serve only metropolitan cities, and television transmitters can broadcast no farther than they can see: 100 miles is a limit seldom reached.

The best solution may be a system of radio relay stations 20 miles apart on the level plains, perhaps 60 miles apart between mountain peaks. Each station, unattended, would pick up the signals from the last station in the chain with parabolic reflectors and beam the program on to the next. Larger cities would have their own television studios and local programs. Smaller communities would have satellite stations picking up the broadcasts from the radio relay chain. The A. T. & T. plans a beginning of such a network with a series of relay stations between New York and Boston, which will cost \$2,000,000 and take two years to complete. That would average \$10,000 a mile; figure out for yourself the cost of a radio relay system reaching into every small town in America.

Nevertheless, television will come to your home. Figures do not stagger the men who believe theirs is the great new industry of tomorrow. NBC looks for 1,000 television stations in the decade after Victory, representing an investment of \$250,000,000; and for public investment of \$3,000,000,000 in 25,000,000 receivers.

The frontier once was measured by acres, valleys, states. Today it is measured by opportunities. Television is one of our greatest frontiers. When the brains that developed radar and all its secret electronic affinities are turned loose on FM and AM and television, that new frontier will be wide open.

In $\frac{1}{50}$ of a second it stops stock-still



WHEN a plane pilot presses the button to adjust control flaps, he wants just so much motion and no more.

But electric motors take time to stop. They overrun.

So while electric controls were desirable because they were less vulnerable and didn't freeze up, they had the disadvantage of overcontrolling.

What you see in the picture is the Lear solution. It is the Fastop Clutch.

With this clutch, controls stop instantly. For it stops stock-still in about $\frac{1}{50}$ of a second.

There is nothing else like this Fastop Clutch. It is built right into the Lear electric motor as a unit.

As with all aircraft equipment, this unit had to meet unusual and rigid requirements of space and weight. It had to have rare power

for its size. In fact the requirements were so severe, old-timers said it couldn't be done.

There will be many new conveniences and devices in the coming days of peace. Perhaps you are already planning one.

And perhaps you would welcome a motor like this and the Fastop Clutch — or some of the other 250 Lear products.

That is why we are telling you about them now. We want you to know that products like these are being made, and that there is available the kind of engineering that made them possible.

PLANTS: Piqua, O., and Grand Rapids, Mich. BRANCHES AT: New York, Los Angeles, Chicago, Detroit, Cleveland, Providence.



you can **SAVE**
your **SAW**
where you **SEE**
this **SIGN**

WE RENDER

**SAW SHARPENING
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● To help conserve tools during wartime, many hardware stores and saw repair shops are offering expert saw sharpening service . . . and displaying this sign in their windows or on their counters.

If you *must* have a new saw, for *essential* work, your Disston dealer will do his best to meet your needs. However, Disston saws and other quality brands are made to give long service and your hardware man knows how to keep them in good condition.

Remember—a sharp saw saves time, trouble and lumber—and gives you a better looking job. See your Hardware Dealer or Saw Repairman today!



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FREE BOOK ON SAWS AND OTHER TOOLS !

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The New Age of Steel

Continued from page 55

steel, they are accurate to one two hundred thousandth of an inch.

Advances in powder metallurgy, and new subzero treatments to increase the toughness, hardness and ductility of steels, presage new applications of steel.

Big figures, of course, are the order of the day in forecasts of steel requirements for such uses as public works program, rehabilitation of war torn countries abroad, and expansion of such successful projects as petroleum pipe lines. At least 28 states have started engineering plans involving great quantities of steel for buildings, bridges, elevated highways, subways or subway stations, and other needs.

With all the advances made in steel uses and fabrication, the large postwar demand that is sure to exist, and the scientific progress that will be unfolded after the war, it appears that the people who called the period before the war "the age of steel," will have to revise the term or think up a new one when the war is over.

Cracking Davy Jones's Locker

Continued from page 59

underwater task that must be performed by divers. A ship that has been torpedoed has extra complications and hazards, for the inward bursting of the explosive charge that sank the ship leaves jagged edges of metal that must be trimmed away with underwater cutting torches before the hole itself can be patched. Cracks and open seams in a sunken ship are welded closed by the divers.

Sometimes a ship can be raised from the bottom by closing most of the holes in her hull and then feeding compressed air through hose lines to her sealed-off compartments, forcing out the water and giving the ship enough buoyancy to float again.

A small vessel such as a submarine that may be resting on the bottom can sometimes be raised without preliminary patching, by submerging huge pontoons, attaching them to the hull, and then pumping them out so that their buoyancy raises the vessel to the surface. On such a job as this the divers use a hydraulic lance to tunnel under the ship's bottom, washing open a channel with water power, so that chains can be passed underneath and fastened to pontoons at each side.

Deep sea salvors believe that their profession will practically die after the present flurry in salvaging ships comes to an

Continued to page 152

Going round in Circles

ABOUT WHAT BATTERY TO BUY ?



Buy the Battery Experts Choose

Be guided by the experts who choose batteries for the world's toughest transportation services. For example, the million-mile trans-ocean flying record was established by a Pan-American Clipper equipped with Auto-Lite batteries.

Auto-Lites, too, are specified for service with our

fighting forces in tanks, half-tracks, jeeps . . . wherever dependable power counts.

Get the long life . . . the extra power you need. Buy an Auto-Lite battery—specified as original equipment by leading automotive engineers.

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Manufacturing Plants at: Niagara Falls, Atlanta, Indianapolis, Oakland, Oklahoma City, Toronto



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IN
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Every Tuesday Night . . . NBC Network
Featuring stars of stage, screen and radio and men and women at the fighting fronts

AUTO-LITE BATTERIES



Patriot, President —and penman!

General Washington, in dark days, led his country toward light. This peerless patriot was also a potent penman—wrote fiats and commands, ledgers, memorable memoranda, with quills of geese.

TODAY, the pen behind the sword is Inkograph—chosen by many generals, and hundreds of thousands of men in service. Easy flowing, precision-built, pointed to fit pressure of any hand, light yet durable, it is as dependable in the field as in the office and home.

If your dealer is out of stock, please keep trying!

Sorry, no mail orders; only dealers can supply you.

*Use any pen to sign up for more
WAR BONDS!*

INK-O-GRAPH[®] 2

Inkograph Co., Inc., 200 Hudson St., N. Y. C. 13



end. After the war, they think, fewer ships than ever will get into trouble. Sea safety will be increased by new scientific aids, the most important of which is radar. This instrument locates distant objects and measures the distance to them by radio waves. Ship captains can expect to use simplified radar equipment to locate ships or coastal points they are approaching in fog or darkness.

Even accidental collisions when entering or leaving port in dense fog may come to an end after the war because of the probability that short wave radio beams will be used, just as they are used now on domestic airways, to guide ships safely to the entrance of a harbor and then guide them along their side of the channel.

Football—Tougher But Safer

Continued from page 31

get more than a scratch or two, while if a player is knocked back as he turns his body, he falls in an awkward position, inviting serious injury.

As a matter of fact, a smart college player who knows how to fall can take an amazing amount of punishment. He doesn't need the protection of the rule that if any part of the ball-carrier's body, other than the hands or feet, touches the ground his advance is automatically stopped and the play ended. For instance, a year before this rule went into effect "Red" Cagle, Army's immortal halfback, played his first professional game with the New York Giants against the Green Bay Packers in the Polo Grounds. Red gained many yards because whenever he was partly tackled and knocked to the ground he would slip from the tackler's grasp, jump up and plunge on a few yards. Red was still a sophomore at heart and every yard gained was sacred ground to him, but by the time the game was over he was pretty well used up by those big Green Bay players.

The next day he told me his body was very sore from the pounding he had taken but the important thing was he had not been hurt because he knew how to fall.

Of course there are other factors which contribute to safety in modern college football. For one thing, equipment is tailor-made for each player. Even the papier-mache thigh guards are made to fit properly to prevent the possibility of a "Charley Horse." Head guards are lined with foam rubber and are constructed so as to distribute the effects of a hard blow, reducing chances of concussion, and shoulder pads are fixed so they stay in position re-

Continued to page 154

THE RECORD BREAKER DOES

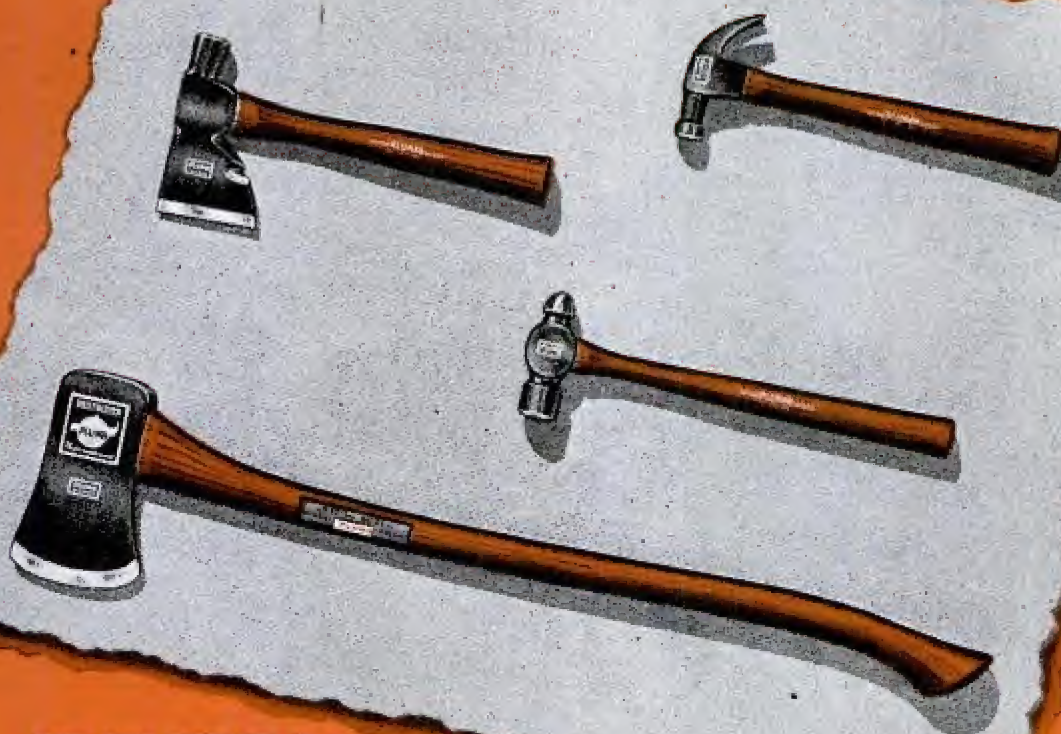
A BETTER JOB TODAY



Once they crowded the shoreline, watched him out-distance all challengers—spurt past the final buoy. Now, in time of war, his ability and skill are put to a more difficult, desperate task. He looks different. But his character is unchanged. Plumb, too, has donned a service uniform. Some of the fine finish is gone for the duration—by Government Order.

But the quality of each Plumb tool is the same. The expertly-shaped hickory handle, the one-piece steel head—tempered with exactness and skill. The hang. The perfect balance. For over eighty years master craftsmen have made Plumb tools—and zealously guarded these features.

Yes, appearance has changed slightly—but Plumb is proud of its service uniform. Fayette R. Plumb, Inc., 4837 James Street, Philadelphia, 37, Pa.



PLUMB TOOLS ILLUSTRATED, Top to Bottom: Nail Hammer, Half Hatchet, Ball Pein Hammer, Single Bit Michigan Axe.

Quality Comes **FIRST**
PLUMB
is **FIRST** in Quality

PLUMB

HAMMERS • HATCHETS • AXES • SLEDGES

IF YOU CAN'T ALWAYS FIND
THE **LHS** OF YOUR CHOICE

Remember

A MAN IN SERVICE MAY
BE SMOKING YOUR PIPE



Besides ever-increasing civilian demand, a tremendous percentage of our production is going to men in the armed services. So, if your dealer hasn't just the LHS you want, model or brand, REMEMBER, ANY LHS IS THE BEST PIPE IN ITS PRICE CLASS.

Model #6

This is an **STERNCREST** PIPE

\$5

YOU HAVE ALL
THESE TO
CHOOSE FROM—AND ALL ARE

LHS DEALERS

AT ALL GOOD

GENUINE IMPORTED BRIAR

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CHOICE AMERICAN BRIAR

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- ◆ Superfine Purex . . . 1.50
- ◆ Sculptured Purex . . . 1.50

Many styles, dozens of handsome models, plain or antique finish—and all are of LHS craftsmanship

FREE—write for our new booklet, "Pointers on Pipes", chock full of pipe lore and pipe do's and don'ts

L. & H. STERN, INC., 56 Pearl Street, Brooklyn 1, N. Y.
(STERN BUILDING)

ardless of how wild the action becomes. Foot injuries are avoided by scientific fitting of shoes and bandaging ankles.

Also whatever injuries do occur are much better treated than they used to be. For example, only in recent years have injuries been treated with physical therapy and whirlpool baths; formerly the only thing done for many injuries was to apply hot towels. Medical attendants have learned to be more cautious in examining players; now if a doctor thinks there is even a remote chance of concussion the player is taken off the field at once on a stretcher.

But the big factor in promoting safety in college football is the attitude of the players. They know that once they master the coordination of muscles football can be one of the toughest and at the same time one of the safest games in the world.

"Glass Eyes" for G. I.'s

Continued from page 37

amine cutting tools. Metallurgical microscopes helped solve difficult problems involved in welding oxygen cylinders for high altitude planes. Microscopes are indispensable to modern chemical research which gave us synthetic rubber and many other strategic items. Microscopes and photomicrographic equipment prevent the jamming of machine guns by testing the metal in the links of cartridge belts.

Many different kinds of optical glass are required to produce these instruments. Each glass is made from a different formula, and requires its own melting, fining, and annealing technique.

One development, which has improved the quality of wartime optical instruments, is a process for applying to glass a microscopic film of magnesium fluoride which reduces surface reflection. Transmission of light through binoculars with uncoated glass surfaces is about 55 percent, but the coated optics increase this to 78 percent.

By combining optical instruments with electronic and mechanical devices, the Bell & Howell Company predicts a new field for development in what it terms "Optonics." These so-called opti-onical instruments of the future will enable you to view a caller at the front door when you are in the workshop in the basement. They may also bring about amazing improvements on airplane and automobile instrument panels.

But whatever develops in the optical field, G. I. Joe will have the edge on civilians for it will most likely be old stuff to him. Don't expect him to gasp in awe, for he's the guy who has been finding targets from one to 20 miles away.

**"THANKS FOR THE
LEAKPROOF BATTERIES!"**



THE FLASHLIGHT BATTERY THAT

STAYS FRESH FOR YEARS

BECAUSE IT'S LEAKPROOF

Here is a battery that our fighters stake their very lives upon. It powers Flashlights, Field Telephones, Flame-throwers, and many other vital war weapons. You can't have LEAKPROOFS for your flashlights now, but millions of our men at the front thank you for your sacrifice.



Ray-O-Vac LEAKPROOF is the battery that stays fresh! Its patented, sealed-in-steel construction holds the power in. Laboratory tests show Ray-O-Vac LEAKPROOFS still alive with power after four years. It's the only battery guaranteed never to cause corrosion damage in your flashlight. After Victory, this is the battery you will surely want.

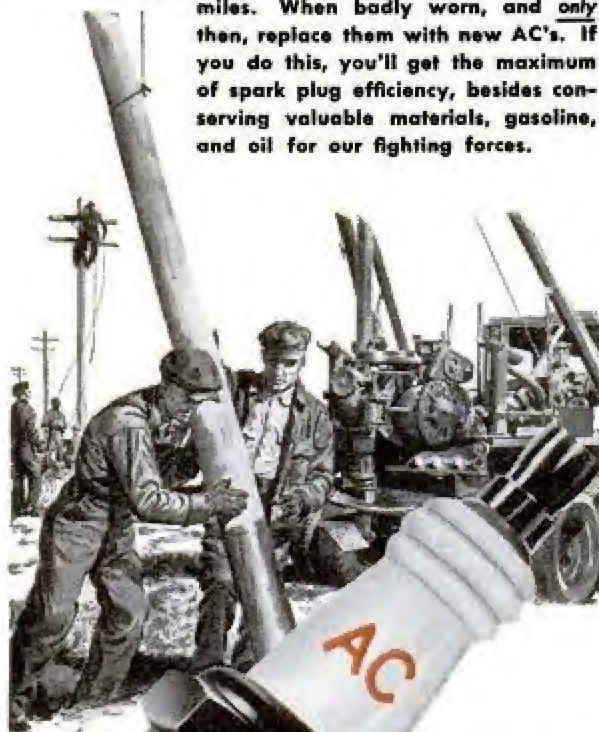
FLASHLIGHTS  BATTERIES

RAY-O-VAC COMPANY, MADISON 4, WIS., Other Factories at CLINTON, MASS., LANCASTER, OHIO, SIOUX CITY, IA., FOND DU LAC, WIS., MILWAUKEE, WIS.

Reliability is the very life of the great public utilities. The public demands reliability from them. They, in turn, must have it in all their equipment.

Like millions of motorists, many utilities get the utmost in reliability from AC Spark Plugs, which help to keep their maintenance vehicles ready and efficient,—day and night, in rain, or snow, or summer heat. And to insure top performance, and long life, they clean and adjust those spark plugs every 3,000 miles.

Profit by the example of these experts. Have your spark plugs cleaned and adjusted every 3,000-5,000 miles. When badly worn, and only then, replace them with new AC's. If you do this, you'll get the maximum of spark plug efficiency, besides conserving valuable materials, gasoline, and oil for our fighting forces.



CLEAN SPARK PLUGS
SAVE UP TO ONE GAL-
LON OF GAS IN TEN



BRING YOUR SOLDIER HOME SOONER
BUY ANOTHER WAR BOND

Secrets of Super-Speed

Continued from page 47

the radiator. There it does two things. It picks up heat, thus cooling the engine coolant efficiently, and it expands considerably.

The exhaust end of this duct is shaped to squeeze the air into smaller volume again, the result being that the increased volume of air has to speed up, so much so that it blows out of the exhaust end of the duct at a slightly higher velocity than the speed with which it entered the front end. The resulting jet propulsion or thrust makes up for the drag of the duct and radiator.

No one knows how fast a speed can be attained by a modern pursuit plane. None of these aircraft can be dived to terminal velocity because they can't climb high enough to reach an altitude from which a dive to terminal velocity must begin. Reports that some planes have reached speeds in excess of 800 miles per hour in dives have been published but many engineers doubt that any aircraft has yet been dived at even 700 miles per hour.

The differences of opinion rest on the lack of a positive way of measuring aircraft speeds. High speeds, especially in dives, are determined by calculations that are based on indicated air speed, which is often less than the true speed through the air, and variables that include the pressure, temperature, and compressibility of the air.

Even so, aircraft have already been dived at speeds at which normal methods of control are ineffective. That is, at high altitude a plane that is placed in a diving attitude tends to increase the sharpness of its dive no matter what the pilot does to try to bring it out of the dive. Not until the plane reaches warmer, denser air at lower altitudes does it respond to the controls. Because of this, fighting planes carry warning notices on their instrument boards that set speed limits beyond which the aircraft must not be dived.

This control complication is due to shock waves of compressed air that act on the control surfaces at speeds in the neighborhood of the speed of sound. These shock waves resist efforts to move the controls. Since the speed of sound drops from about 750 miles per hour at sea level to around 680 miles per hour at 30,000 feet, the effect is first observed at high altitude. Not much is yet understood about these effects of air compressibility but it seems now that if and when practical aircraft that can fly in the range of the speed of sound are built they will need to be provided with some method of control that is quite different from the present system of control surfaces.

IT'S HEADS DOWN AND THROTTLES WIDE

—when the Storm Boats
hit the beach!



BELLY-flat and heads down, nearly a ton of rugged fighting men and their battle gear cover the bottom of each racing Storm Boat when it slashes for the beach — hits the shore — leaps bodily from the water and disgorges its crew!

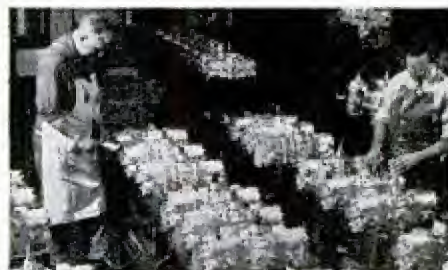
High speed, and the darting maneuverability of an angry hornet are the Storm Boats' defense against hostile fire. The great Evinrude "storm boat motors" provide both, make the Storm Boat one of the most spectacular of small assault craft.

1 The speedy Storm Boat is useful for many other tasks! Here one is shown tearing over the water loaded with a 37-mm antitank gun, together with two-man gun crew, ammunition, and the operator. Machine gun squads and mortar squads are among other standard storm boat "cargoes"



2 Storm Boat on patrol. The hull draft is only a few inches, and like all other Evinrudes the big motor tilts readily over obstructions, making the storm boat adaptable for operation in the shallowest of waters. The bottom is well compartmented to make the boat practically nonsinkable.

3 The high efficiency of the storm boat motor has won for it other important assignments. Here are storm boat motor power heads specially built to power high-capacity portable pumps . . . "last-ditch" fire fighters for use when a ship's main fire-fighting equipment has been blasted out of action!



All of Evinrude's facilities are now devoted to production for Victory. With peace there will be sparkling new Evinrudes for all to enjoy. EVINRUDE MOTORS, Milwaukee 9, Wisconsin



Every Dollar You Invest Helps Speed Victory — Buy More Bonds

EVINRUDE

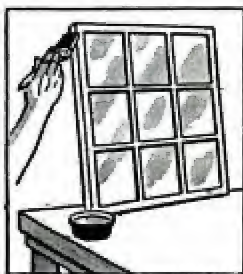


OUTBOARD MOTORS

WORKSHOP WISDOM

How to make windows slide easily

To end the annoyance of sticking windows and drawers, follow these easy directions:—



1. Clean off any excess paint . . . sandpaper smooth all sliding surfaces.

2. Apply a thin coat of Cascamite to these surfaces. Let dry and sandpaper again lightly.

3. Rub frames with paraffin or wax candle.

Cascamite will sink into the wood pores, harden, and help prevent future swelling or sticking.

Cascamite for scores of wood-gluing jobs because:

It's Waterproof. Ideal for jobs exposed to weather, water, or excessive dampness.

It's Stronger. By actual tests, joints made with Cascamite are as strong as the wood itself.

It's Economical. Comes as a dry powder which keeps well, doesn't "dry up." Mix (in cold water) only the amount you need for the job.

You can get Cascamite Plastic Adhesive—as well as Casco, the all-purpose household glue—in 10¢, 25¢, and larger sizes at all hardware stores.

Send for free Casco Project Booklets and free Gluing Guide containing 80 household gluing hints. Drop a post card to Casco Company of America, Dept. P1, 350 Madison Avenue, New York 17, N. Y.



CASCAMITE

Plastic Adhesive

Cameramen Under Fire

Continued from page 69

The first combat films were brought back by a sergeant who stepped off a boat and into a minefield in three feet of water at H-hour. Thirty seconds later shrapnel wounded him in the upper left arm. The sergeant stumbled, but held his camera above water as machine gun bullets swept the surf and the shore. Wading onto the beach, the sergeant shot hundreds of feet of film before he consented to return to a hospital in England.

Another signal corps hero was a youth who was carried off the beach across the channel to a field hospital. His left foot had been blown off and there were wounds in his arm and thigh. But as he was hoisted on the operating table he said, "Please, doc, I've got some film in my camera and it's important. Please call headquarters."

Naval photographers, too, "performed wonders" in making historical records of the initial landings. At the start of the war the Navy had 300 photographers' mates; now it has more than 3,300.

Ducking bullets is only part of a war cameraman's worries. Usually he grumbles far more about the photographic problems brought about by extreme climatic conditions. Filan complained that at Vella Lavella, where it was particularly wet and warm, the cardboard boxes containing his film came apart and the pasted ends of the film rolls opened by themselves.

"Aside from the abundance of moisture," he said, "the biggest handicap is the lack of light. I believe if we had an exposure meter we'd go crazy as I'm sure it would indicate that daylight pictures were impossible. I got thin negatives even shooting with the lens wide open at a tenth of a second on the fastest film obtainable."

Ants and rats ate holes in the equipment bags of Tom Shafer, Acme photographer in the South Pacific, but that was the least of his troubles.

"The rains here are terrible and the camera equipment just cannot take it," he wrote to the home office. "Every time I make a landing it seems to pour cats and dogs and I have to get my cameras rebuilt. It causes moisture condensation between the lenses and I can't get them apart for cleaning because of the rust. The film packs are ruined by every rain."

Accompanying the first assault wave on landing operations is no set-up for picture-taking, according to Shafer. He said he always was so busy digging a foxhole that he had little time left for his camera.

(To be concluded next month)

Why This Kind Of Oil Heater HEATS YOUR HOME LIKE A FURNACE

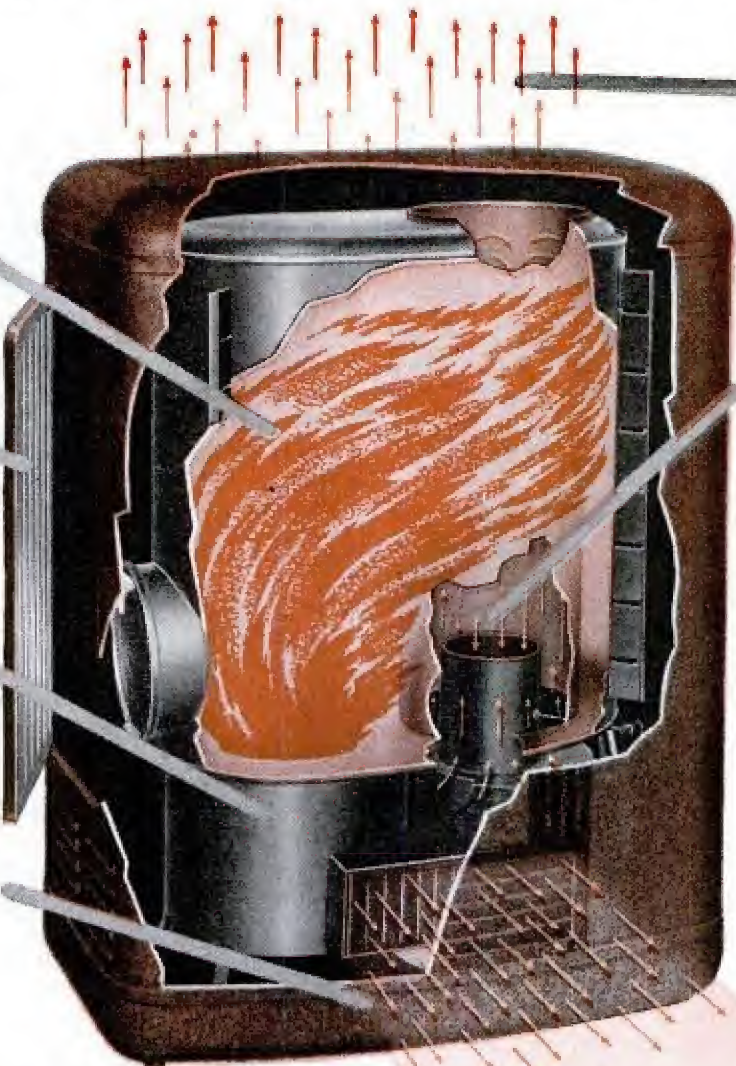
... And Brings You 3-Way Comfort From One Appliance

50% More Heating Area—and 50% longer flame travel—means more heat delivered into home, less heat lost up the chimney. Note heat-radiator fins—they help increase warm air circulation 25%!

Quick-Warm-Up Radiant Heat—the penetrating, "bone-warming" kind, floods out when you open these heat-reflector doors.

High-Efficiency Coleman Burner—For extremely clean-burning flame; low carbon, maximum heat from fuel. Low-flame fuel saver allows 50% lower adjustment for cool days.

Directed Warm Air-Flow Along Floors. Coleman Power Blower draws warm air from Hot Tube Radiator (upper right). Adjustable louvers direct this warmth where you want it!



Billows of Warm Air—through big open grill top. Outer casing is built to pull air like a chimney. Pulls in floor-level air for heating by big heat unit. Actually gives forced warm air without moving parts! Keeps floors warm; circulates fresh warmed air 3 to 5 times an hour!

Hot-Tube Radiator does two jobs!—Provides extra heating surface for warming more air—a bigger warm-air flow; supplies warm air for directed heat along floor through Power Blower.

All This, Plus Automatic Ease! Burns clean, low-cost oil. No fuel dust, dirt, soot or ashes. Automatic controls available, so you "tend the fire from an armchair," and get warm floors, even heat from floor to ceiling, and warmth that circulates through the house—not just one room!

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BACK THE ATTACK WITH WAR BONDS
BUY MORE THAN BEFORE

Springboard for Victory

Continued from page 5

This war against mileage as well as against the Japs not only tops the record of any previous war but demonstrates the utter failure of Japan's defensive strategy. Some of the most powerful Japanese bases in the Central Pacific were overwhelmed even faster than less powerful ones in the Southwest Pacific.


Japan's failure to use, effectively, her land-based planes to beat off attacking American fleet units and her naval strength in repulsing landings on vital bases was due, in large measure, to her limited sea and air power. More particularly, however, it was due to the growing strength of the American navy, especially in aircraft carriers, of which nearly 100 are now in the Pacific. Each task force is capable of putting 1,000 planes in the air at once.

The tremendous losses sustained by the enemy at Saipan and Guam, and his failure to stop the advance to the Marianas not only show that we can take anything Japan holds, but also portend her ultimate defeat. Continuous blows on Japan's inner defense line will prevent her from concentrating a superior naval force at any particular point.

In the coming campaigns the American navy will have freedom of decision and of action. The decisive battle will start with blows on the Eastern front, combined with blows from the north, south and west.

Though the enemy's main fleet is still strong, it has failed, not only in its main mission of preventing the American fleet from operating close to Japan's home islands, but also in protecting Jap troop convoys and supply ships. Japan's navy has been whittled down considerably by American surface vessels, aircraft and submarines. The most effective threat of Japan's sea power, therefore, lies in the existence of her "fleet-in-being," for that, as a con-

Continued to page 162



Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	3/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	3/32
Weight, Grams	8	3 1/2	2 1/2

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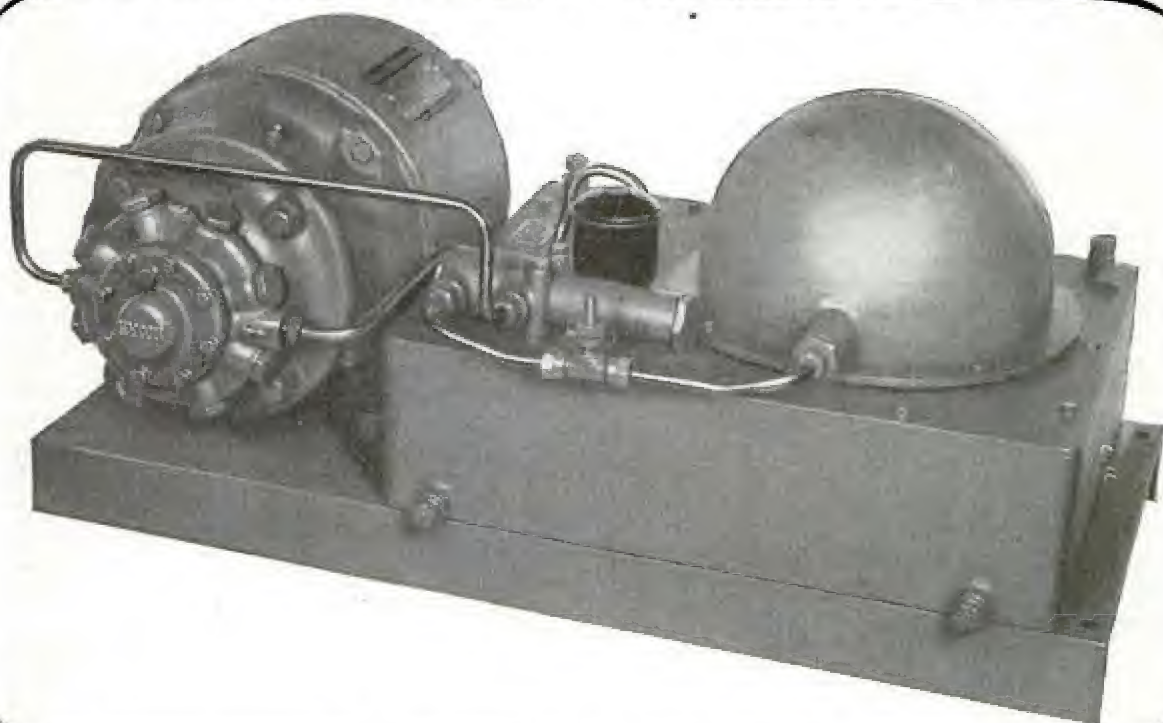
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"3-IN-ONE" OIL

tinuous menace, influences the disposition of American naval forces. Japan has kept her "fleet-in-being" only by avoiding action, and at a great price—the abandonment of the outer defense perimeter.

As the Tokyo war lords know full well the war is lost, their sole object is to delay defeat in hope of a negotiated peace.

At sea Japan has neither the forces nor the strategic ability for a protracted defense. Had her strategy been different, in the earlier stages of the war, she might have been able to stave off invasion of the Gilberts and Marshalls by concentrating her fleet in the Central Pacific instead of having it run to cover. Even later, she could have gathered her main forces off Saipan instead of sending a boy to do a man's job in an attempt to interfere with the American invasion, and thereby losing a battle which not only disrupted her aircraft carrier force protecting the Philippines, but started Japan on the last lap to disaster.

Prior to the Saipan campaign Japan's principal chain of island defenses extended from the mainland to the Carolines through the Bonins and the Marianas. Reinforcements, supplies and planes were sent by this route to garrisons in the South and Southwest Pacific. Occupation of the Marianas, however, changed this procedure. Vital supplies to Japanese forces in outlying bases are blockaded, leaving the garrisons to die or surrender. With the Marianas in American hands and the isolation of the once formidable bases in the Carolines—Truk, Ponape, Yap and Palau—the road to the Philippines and Japan lies open. Both of these targets are within range of land-based planes on the Marianas.

Paralleling the fleet's westward march in the Central Pacific, is General MacArthur's campaign in the Southwest, which is making similar progress toward the Philippines, thus securing Admiral Nimitz's left flank. These offensives form a coordinated pincers toward the Philippines. Reconquest of the Philippines, however, is only a step toward domination of the China coast.

Once these islands are under American control, Japan's communications to the Dutch Indies and other southern outposts could be cut, leaving her garrisons to perish for lack of supplies and curtailing her oil supply, on which both fleet and plane operations depend. With her lifelines thus severed, Japan's ability to fight would suffer a heavy blow, and her whole "Co-prosperity Sphere" be doomed to collapse.

(Note: The opinions expressed and the assertions made herein are my own and are not to be construed as official or reflecting in any way the views of the Navy Department or Naval Service at large.)



"Young man — you have it!" said the Wizard of Menlo Park

IT IS A warm August evening in 1896. Around a banquet table on Long Island sit Thomas A. Edison and the country's leading men of the electrical industry.

The talk swings naturally to politics, to Bryan and McKinley and the Cuban situation—then back again to business. There is high discussion about storage batteries to drive America's "horseless carriages". Someone points to young Henry Ford, Chief Engineer of the Detroit Edison Company, and says: "There's a man who has built a gas car!"

At once, Edison eagerly begins to ask questions—and to listen. "How do you explode the gas in

the cylinder? Do you do it by contact or a spark?"

On the back of a menu, Henry Ford sketches the details of his engine. Edison thumps the table so hard the glassware tinkles.

"Young man, that's the thing—you have it. Keep at it. Your car is self-contained—carries its own power plant—no fire, no boiler, no smoke, and no steam. *Keep at it!*"

Here was just the challenge and encouragement which Henry Ford needed most. It was something he never forgot. And through the years, keeping-at-it has remained a firm tradition of the Ford Motor Company as it has

moved forward in the creation of 30 million reliable cars and trucks.

It is this keeping-at-it in research, in engineering and production, that has made the Ford name a synonym for smart, comfortable, economical transportation, priced to serve the needs of the greatest number.

In peaceful days ahead, the new Ford, Mercury and Lincoln cars will reflect all the established Ford skills and inventiveness. Their advanced styling will match their quality leadership, and they will benefit by the newer knowledge of materials and techniques being achieved as Ford *keeps at it* in making the tools of victory.

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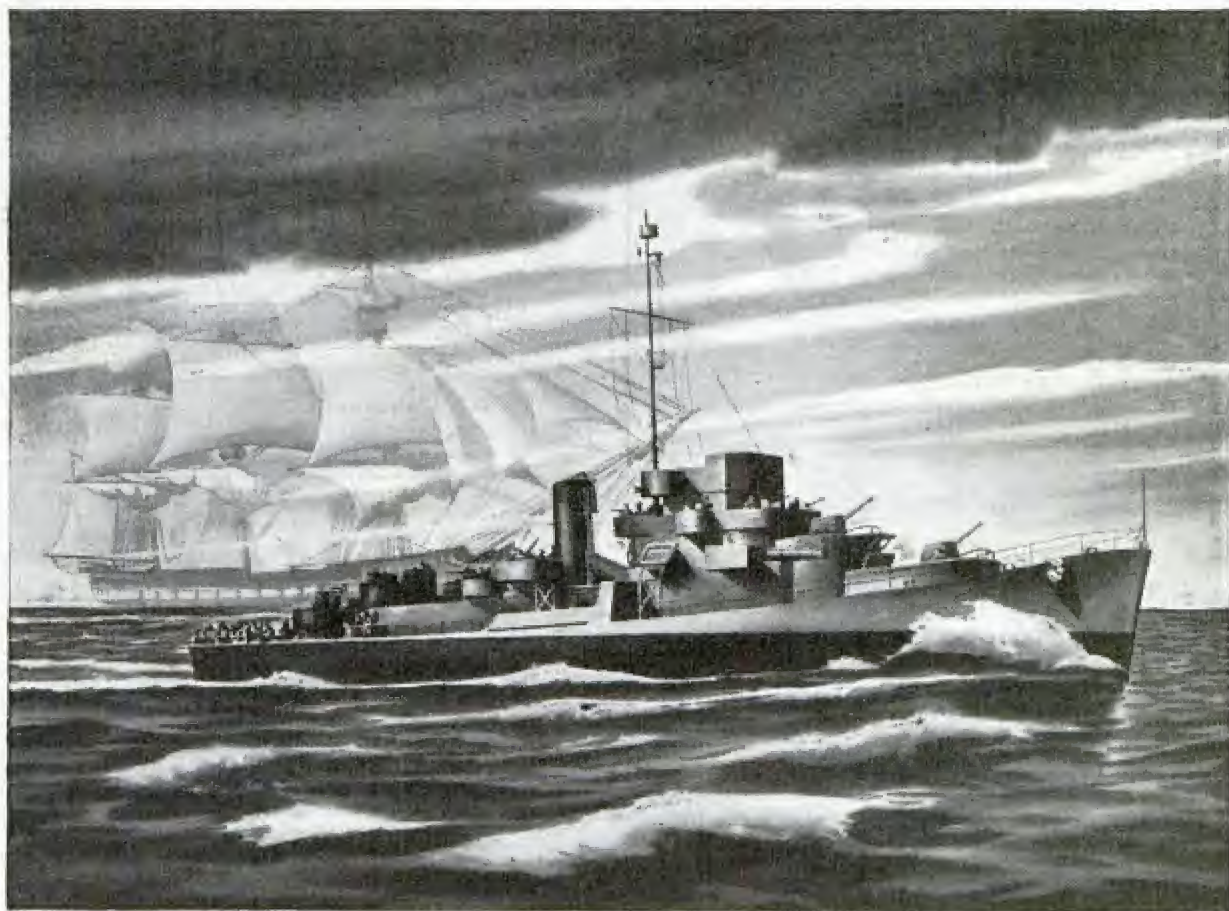
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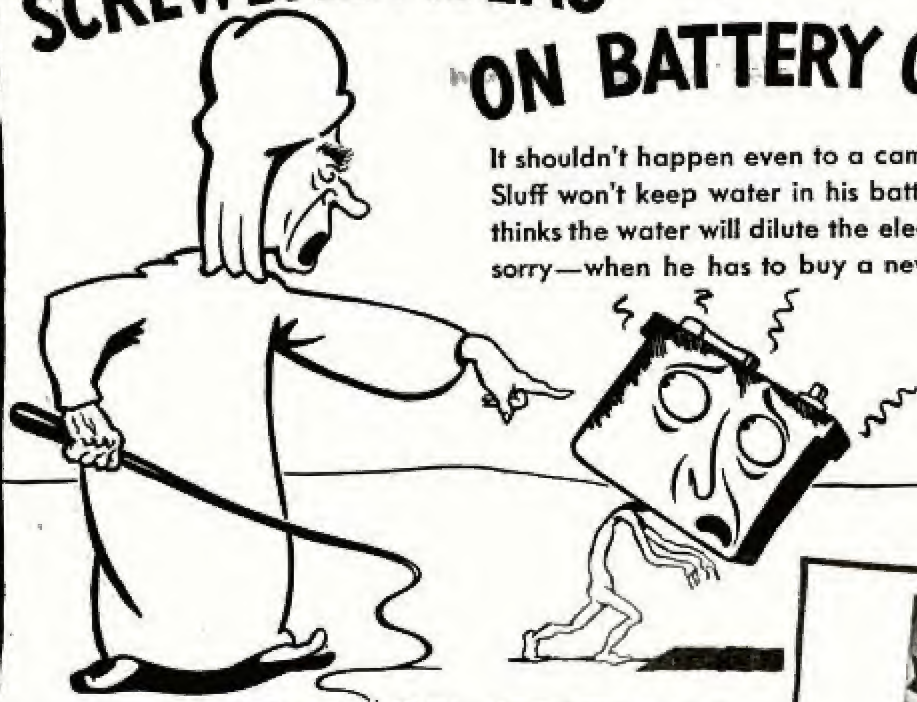
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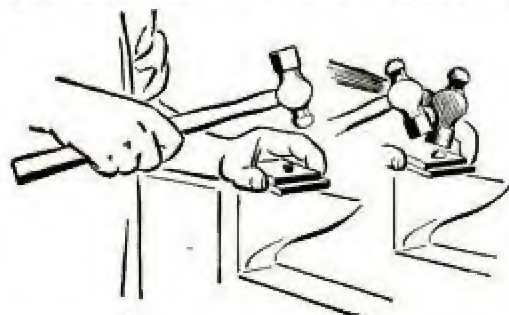
- 1 Don't buy *anything* you can do without.
- 2 When you **MUST** buy, insist on dependable, long-lasting merchandise.
- 3 Take care of the things you have. *Make them last!*

These conservation rules save materials for war production, help curb inflation, give you more money to invest in War Bonds.



Tool Tips by STANLEY

Use of Ball Pein Hammer

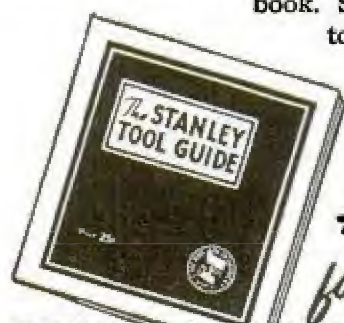


To rivet with a ball pein hammer, place the parts together with the holes in line and insert the rivet. Support the head of the rivet on a solid object, such as a vise anvil, and strike straight down on the rivet with the ball pein; head the rivet over with the ball pein or with the hammer face.

To raise a curved or bowl-shaped form in malleable metal, hold the work over a suitable hardwood form and beat it out with the ball pein.

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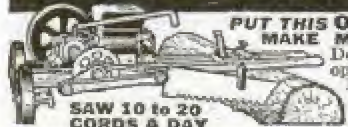
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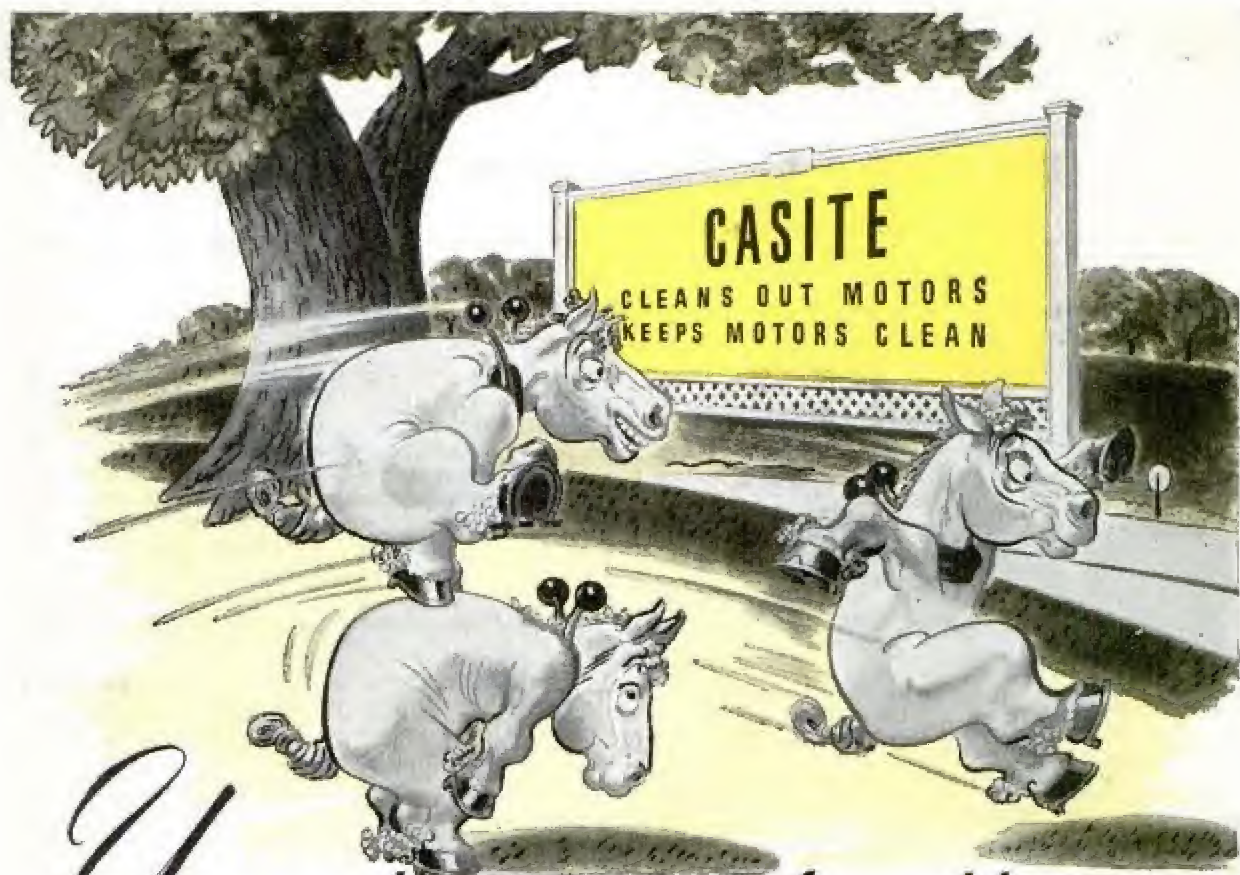


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Young horsepower for old cars

Ever see the inside of your motor? Well, it's a maze of little pipes and passages that choke up with power-destroying sludge and gum. You can clean these out, and keep them clean, with Casite.

**Better and Smoother Performance
or Double-Your-Money-Back**

It's as simple as that. Either your motor

runs better and smoother, or you get back *twice* what you paid. Used through the carburetor, Casite gives an effective tune-up at low cost. Added to the crankcase oil, it stays on the job from one oil change to another.

Sold by service stations, garages and car dealers coast-to-coast at 65¢ a pint.

THE CASITE CORPORATION • HASTINGS, MICH.

Guarantee

Add Casite to crankcase and run through carburetor according to instructions, then drive your car 100 miles or for 60 days, whichever is first. If not convinced that Casite gives you better and smoother performance, you get double your money back by filling out guarantee certificate and mailing it to The Casite Corporation, Hastings, Michigan. Maximum refund is \$1.30 per pint, twice the nationally advertised price of Casite.



WHE-E-E-E GET CASITE AND GO!



IT'S A PRIVILEGE

TO BUY WAR BONDS



**HE HAS
YOUR BATTERY**

Today flasher signal lights and invasion-barge search-lights are more important than battery-powered lights on the home front. Burgess Batteries go *first* to the men who need them most, so we'll all have to take better care of what batteries we may have. Keep them cool and dry . . . use them as little as possible and rest them as *often* as possible. For Free Battery Hints—Write Dept. E-2, Burgess Battery Company, Freeport, Ill.

Paper Packs a War Punch—Save It!



BURGESS BATTERIES

IN THE NATION'S SERVICE

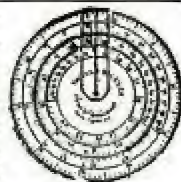


How to live with a pipe —and like it

Pipe-smokers who wander along tobacco roads in search of deep and abiding satisfaction are urged to send for their free copy of "The Choice of Experience." Here, in narrative form, is a brief and readable history of Walnut . . . John Middleton's master-blend of the world's 7 finest tobaccos . . . mild, fragrant, friendly, *naturally* aromatic. It starts in a little tobacco-shop along the old Philadelphia water-front in 1856. And it brings, in addition to the booklet, an ample sample of Walnut. All for a penny postal addressed to John Middleton, 1201 Walnut (Tobacco) St., Philadelphia 7, Pa.

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● Fits the pocket. Quickly solves any problem in multiplication, division, proportion. Gives the square, the square root, logarithm and reciprocals of all numbers. Trig scales give sines and tangents of numbers. Fine black graduations on white celluloid. Complete with instructions. Price in fabricoid case \$1.00, in leather case \$1.25. Money back if not satisfied. Special offer to agents and dealers.



MONITOR SLIDE RULE—6" Dia.

Made in white Vinylite. Same scales as Mascot Slide Rule. Complete with instructions. Without case, \$2.95. Leatherette case, 75c addn'l.

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RUST INHIBITOR




Keep home tools, appliances, corrosive metal protectively coated.

35c Bottle Hdws.—Spkg. Goods Dealers
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BUILD-ARC WELDER FROM OLD GENERATOR

For Light or Heavy Work. 30-200 amperes. Complete PLANS 35c. Send today and we'll include FREE our Big NEW Catalog.

LEJAY MANUFACTURING CO.
1347 LeJay Bldg., Minneapolis, Minn.



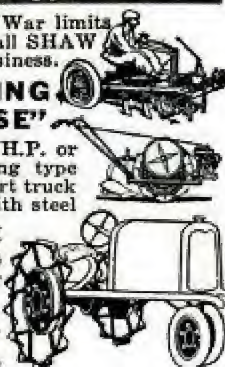
SHAW and "Peppy-Pal" GARDEN TRACTORS

● 1 to 9 H.P. Circulars on request. War limits production—We supply repairs for all SHAW Tractors sold in our 40 years in business.

BUILD YOUR OWN RIDING TRACTOR—"WAR HORSE"

using old auto parts, powered by 2 H.P. or larger air-cooled engine; or walking type Garden Tractor 1/2 to 3 H.P. or convert truck or auto into Farm Tractor. Each with steel or rubber tires; will plow, cultivate. Plans for building; in few hours, any one of above, postpaid for \$1.00 (state which wanted) or all 3 for \$2.00. Money Back Guaranteed!

SHAW MFG. CO., 4510 Front St.
Galesburg, Kansas
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Prize
in contest which
you have a chance
to win!

(Retail value)

in Delta equipment for a Homecraft Shop

that bring happiness to you

Your choice of \$1,000.00 in Delta Equipment (retail value)

**Your choice of
\$500.00 in Delta Equipment
(retail value)**

**Your choice of
\$250.00 in Delta Equipment
(retail value)**

Your choice of
\$75.00 in Delta Equipment
(retail value)

**\$10.00 worth of Delta
Accessories and/or Supplies!**
(retail value)

(Merchandise certificates will be awarded to winners entitling them to prizes when materials required for making Delta equipment are released by the government.)

Set of 27 Delta-Craft Project Books and Manuals! \$4.50 value! A complete education in modern shop practice.

Set of 6 Delta Tool Manuals — Value \$1.50! Shows how to master tools and operations.

1 Year's Subscription to The Deltagram! Value \$0.50. The popular, plan-packed homemaker's magazine.

Think of it—you have a chance to get \$1,000.00 worth of famous Delta equipment (post-war delivery), or one of 199 other valuable Delta prizes, *absolutely free!*

What a swell opportunity to have a complete Delta-equipped homecraft shop you can really be proud of—and where you and all the family can enjoy fun and healthful recreation!

All you have to do to become eligible for these big prizes is simply
HM-18

tell us in your own words your idea of a practical homecraft shop. Maybe it's that shop you've been dreaming about — or perhaps it's an improvement on the one you now have.

Whatever it is, simply send us a sketch of the floor plan (we don't expect a finished drawing) — together with a statement covering the points listed in the rules below. Include any ideas you think can put you among the winners.

This exciting contest closes Tuesday, October 31, 1944. Your entry must be postmarked not later than midnight of that day.

So don't delay. Start your plan right now. And be sure to mail it on time.

DELTA
MILWAUKEE
Power Tools

I The contest is open to any person of any age (male or female) residing in the United States or Canada, except employees of The Delta Manufacturing Co., dealers and distributors of Delta products and their employees, employees of Delta's advertising agency, and members of the immediate families of any of the above.

2 Entries are to consist of a floor plan or layout of the entrant's proposed post-war homecraft shop showing position of power tools, workbenches, and other major equipment, together with a statement giving the following information:

- A. Reasons for adopting layout and equipment shown in floor plan.
- B. List of power equipment now owned.
- C. List of power equipment planned for purchase after the war, the prices you would pay, and name of store where purchase would be made.
- D. List of hand tools and other accessories now owned.
- E. General type of work to be done in the shop.

3 Entries will be judged on their suitability to the type of work to be done, efficiency and ingenuity of arrangement, and use of space available. Neatness and clearness will count, but not costliness or elaborateness of the proposed shop, or elaborateness of the presentation.

4 All entries must be postmarked not later than midnight Tuesday, October 31, 1934. They are to be mailed to Contest Editor, The Delta Mfg. Co., 681L E. Vienna Ave., Milwaukee 1, Wis. Entries become the property of The Delta Mfg. Co. to be used as they see fit, and none can be returned.

5 Decisions of the judges will be final. In case of ties, duplicate medals will be awarded.

6 Contestants are limited to one entry. If more than one entry is submitted by a contestant, only the first one received will be considered.

7 Final judging will be done by:
William Bachrach, Regional Co-ordinator of Engineering, Science and Management, War Training.
E. R. Haan, Technical Editor, Popular Mechanics.
Harry Walton, Home and Workshop Editor, Popular Science.

NEW! "SLIDE RULE" for Woodworkers



Special wartime offer by the makers of famous GREENLEE tools for craftsmen.

ONLY
10¢

You just set the dial and . . .

- Convert linear to board feet
- Determine slope per foot in degrees
- Compare hardness, weights, shrinkage, warping, ease of working of various woods
- Find bit sizes for head, body and thread of standard screws
- Determine nail specifications
- Get helpful tool sharpening tips

Heavy varnished cardboard . . . soil-proof . . . 6 inches in diameter . . . fits tool kit.



Send for yours now!

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☐ Enclosed is 10c. Send your "Handy Calculator" by return mail.

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Address _____

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DRILL PRESS OWNERS!

HERE'S 1 TOOL WITH 5 DISTINCT USES
**THE BARRON MULTI-PURPOSE
ROTARY WOOD PLANNER**



PLANES & SURFACES • PANELS & BEADS
ROUNDS & GROOVES • RABBETS • TENONS

\$750

Converts ANY drill press into a time saving, low cost planer, paneler, tenoner, etc. Surface finishes all types of tough grained and knotty surfaces to agree smoothness. Safe! Guaranteed harmless to drill press. Thousands now in use. **SOLD ON MONEY BACK GUARANTEE.** Full refund on 5 day trial. Shipped prepaid on receipt of \$7.50—or C.O.D. **YOU RISK NOTHING.** Free literature.

**STEEL TOP AUXILIARY
DRILL PRESS TABLE**

Has 300 sq. in. smooth working surface. Equipped for shaping and many other important workshop uses. **\$595**



Barron Tool Co., 369 Architects Bldg., Detroit 1, Mich.

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FREE! Six Months' subscription to **PIPE LORE** . . . crammed full . . . illustrations, helpful hints ("How To Keep Your Pipe Sweet"; "How To Blend Tobaccos"); pipe-news about new styles, inventions, and collections; pipe and tobacco bargains, pouches, racks, humidors, and pipe gadgets. We cater to pipe-smokers **EXCLUSIVELY** . . . as specialists we save you money. Get the next six issues of Pipe Lore **FREE**, no obligation, of course. Act Now! Send this ad and your name and address to

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\$1.00
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Try it! See the Added Beauty

With this **NEW TOOL**, (not a brush) everyone can now draw lines with paint, enamel, lacquer, etc. Used on autos, models, toys, games, imitation tile walls, cabinets, furniture, linoleum floors, signs, bulletin boards, sporting goods, home workshop projects, etc. Send only \$1.00 for complete tool for painting a 1/16" wide stripe, including adjustable guide, operating instructions, etc. C.O.D. price \$1.25.

As easy to use as a pencil.



Patented

Extra interchangeable tips for making 1/64", 1/32", 3/64", 1/16", 3/32" and 1/8" wide stripe lines—.50¢ each.

Every Painter and Craftsman Should Own One.

Send for your tool and as many additional width tips you need today. Use it. If you are not satisfied that you can do better work, add character as well as beauty to your product or project, return the tool and we'll refund your money promptly.

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Build: STEAM ENGINE

● A precision built and engineered single cylinder, 1/4" scale marine model, with clutch or reverse.

● Send \$2.50 for 14 pages scale drawings, 2 photos, instructions.

● 2 Photos and Description...\$.25

● Rough Castings Kit...\$2.50

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Drawings and Instructions 1.00

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Every Outdoor man a prospect. Smartest color and style combined with warm snug comfort. Genuine **ALL WOOL Buffalo Check Shirts**. Full cut, patented storm cuffs. Amazingly low priced, with generous profit for you.

COMPLETE LINE—Leather and wool jackets, raincoats, 200 fast selling shoe styles for men and women. Our salesmen making biggest profits in this field, using Actual Samples we furnish **FREE**. Write today for **FREE SAMPLE OUTFIT**.

MASON SHOE MFG. CO., Dept. M-144, Chippewa Falls, Wis.

"WITH THE WIND BLOWING MY HAIR AND SINGING A SONG IN MY EARS"



"I was in Alaska over a year — am now somewhere in the Aleutians. The Harley-Davidsons here are doing praiseworthy work and giving faithful service. It's good your machines are made to stand hard punishment. I long to be back in the saddle of my own faithful Harley-Davidson again — *with the wind blowing my hair and singing a song in my ears.*"

The story is always the same. Thousands of letters tell of Harley-Davidsons' superior performance under severest war action. And thousands of riders tell how eager they are "to get this thing over with so we can have a new HARLEY-DAVIDSON for the thrilling motorcycling days to come." **BUY WAR BONDS NOW**, to make those days come soon!



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Please send at once free copy of 24-page
"Enthusiast" Magazine, filled with motor-
cycle action pictures and thrilling stories.

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REAL HONEY



\$1.00
STANDARD
"Dublin" Shape

the honey-cured smoke

A mellowing and curing agent, of the proper thickness, the honey lining has endeared these Yello-Bole Pipes to thousands of men since 1933. For there's no "breaking-in," with a Yello-Bole. It smokes like a seasoned, trusted pipe, from the beginning. Honey does it (it's in that yellow bowl). Fine pipe-bowls, with Nature's markings. If your dealer hasn't got them, it's because we're supplying the men in ships and fox-holes, first, and your dealer will have your Yello-Bole soon.

YELLO-BOLE STANDARD \$1
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Say you saw it in *Popular Mechanics*!

FILLS FLOOR CRACKS!

Holes and cracks in floors can be quickly repaired with **PLASTIC WOOD**! Handles like putty; hardens into wood. At Paint, Hardware, and 10¢ Stores.

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HOOK WORMS
WHIP WORMS**



...you can free your dog of all these worms

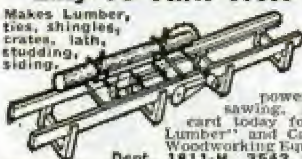
with **PULVEX**
COMBINATION TREATMENT **WORM CAPSULES**

Used by leading breeders. At leading pet, drug, department stores, 50¢ a package (double size, 75¢). Packed two ways: for puppies, for dogs.

ONE-MAN SAWMILL LESS THAN \$135.00

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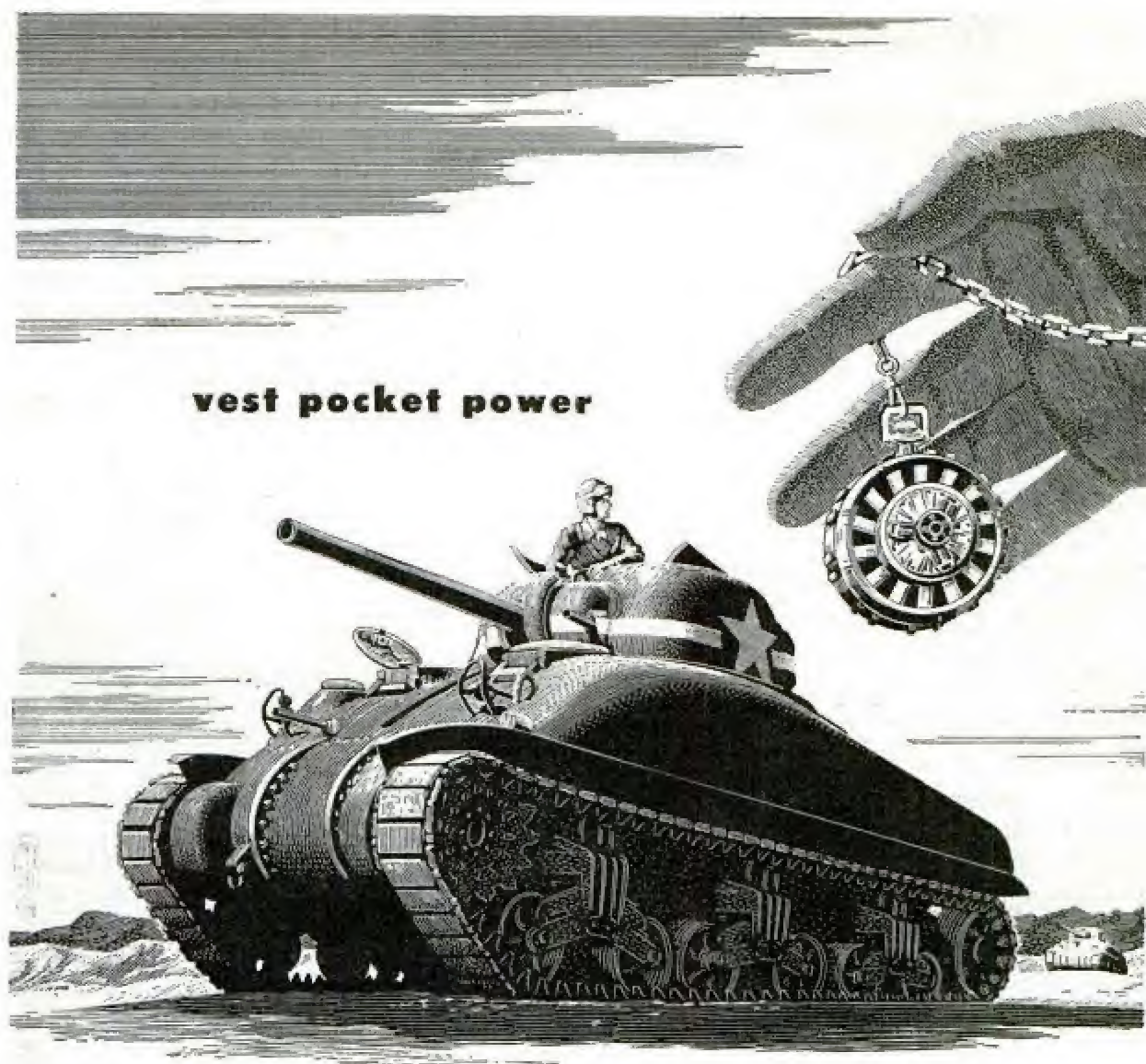
in every battle...
doing vital jobs...
unfailingly...



that's why there are just a few left for essential jobs at home

BRIGHT STAR BATTERY CO., CLIFTON, NEW JERSEY

POPULAR MECHANICS



Why put an air-cooled aircraft engine in a tank? Because no other engine packs as much power into such small size. Tanks and gun carriers slog into battle on caterpillar treads, but they are similar to aircraft in that they require an engine high in power, small in size, and light in weight. Other engines of equal power are massive, creating a vicious circle in which large size demands more armor plate, in turn adding weight and calling for more power to maintain speed.

Seasoned by years of operation in transport, private, and trainer planes, the Wright

Whirlwind was the logical choice for the Army's medium tanks and gun carriers. This engine, weighing but a scant 1% of the M-4 tank's 30 tons, packs 400 HP plus in its 45" diameter.

Enlisted in our armored divisions, the Whirlwind was assigned to combat duty with virtually all medium tanks and heavy gun carriers to reach the fighting fronts. In no sense a competitor to the air tonnage hauling Cyclone, the Whirlwind has nonetheless lived up to the Wright tradition for light, compact power, adaptable to many purposes.

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THE PAINT OF TOMORROW—TODAY! Imagine cosying and beautifying your home, inside and out, with a film of real plastic, tough, tenacious, deeply beautiful... which neither sun, rain, fumes, or smoke affects. That's **PLASTI-COTE**, the amazingly durable plastic paint, which anybody can apply.

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This Horseshoe Ring, Handmade, Hand - engraved, inlaid with simulated pearl, is a **KNOCKOUT!** Shoe and shank of everlasting Monel Metal is

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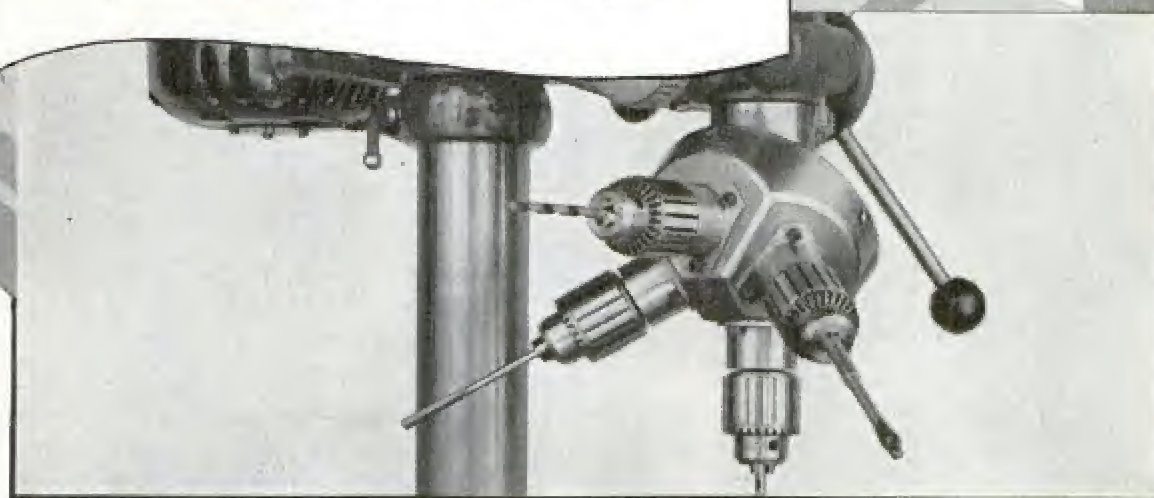
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Ingenious New Technical Methods

Presented in the hope that they will
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Amazing New Four Spindle Turret Attachment for Drill Press!

Now one drill press can do the work of four and, at the same time, effect a savings of up to 75% in floor space, with the "Quadrill" attachment. This rotary device will accommodate four boring or cutting tools at the same time, yet one tool *only* is in motion when the head is in operating position.

The entire unit is assembled to the quill of the drill press and is driven from the drill press spindle. Accuracy and rigidity of alignment of the "Quadrill" are assured by the special construction of the driver and spindles, thus efficiency is only limited by the accuracy and power of the drill press itself.

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Quick and positive indexing assured
by pointers on index disc



Quadrill assembly complete ready
for attachment to drill press

Y-143

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UNION MADE WORK CLOTHES

50 Years a Friend to Organized Labor



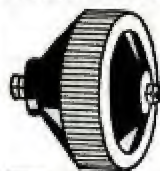
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BEFORE—Bristles caked, stiff, useless. **AFTER**—Bristles silky-soft and flexible—ready for easier—faster—better painting. **DIC-A-DOO** Paint Brush Bath makes the difference. Restores old brushes. Saves new brushes. Buy 5¢ package, 10¢ box at PAINT, HARDWARE, FIVE & TEN CENT STORES.—The Patent Cereals Co., Geneva, N. Y.—makers of **DIC-A-DOO** Paint Cleaners.

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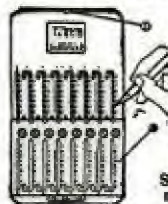


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*Prices F.O.B. Arcade, N. Y. Slightly higher west of Rockies. Stand illustrated extra.



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2 Pipes
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17 Jewels

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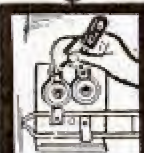
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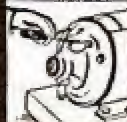
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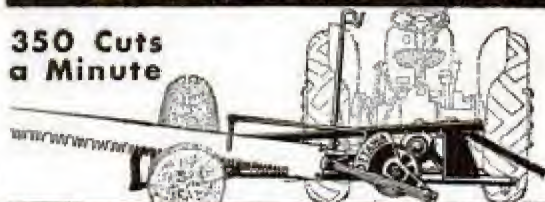


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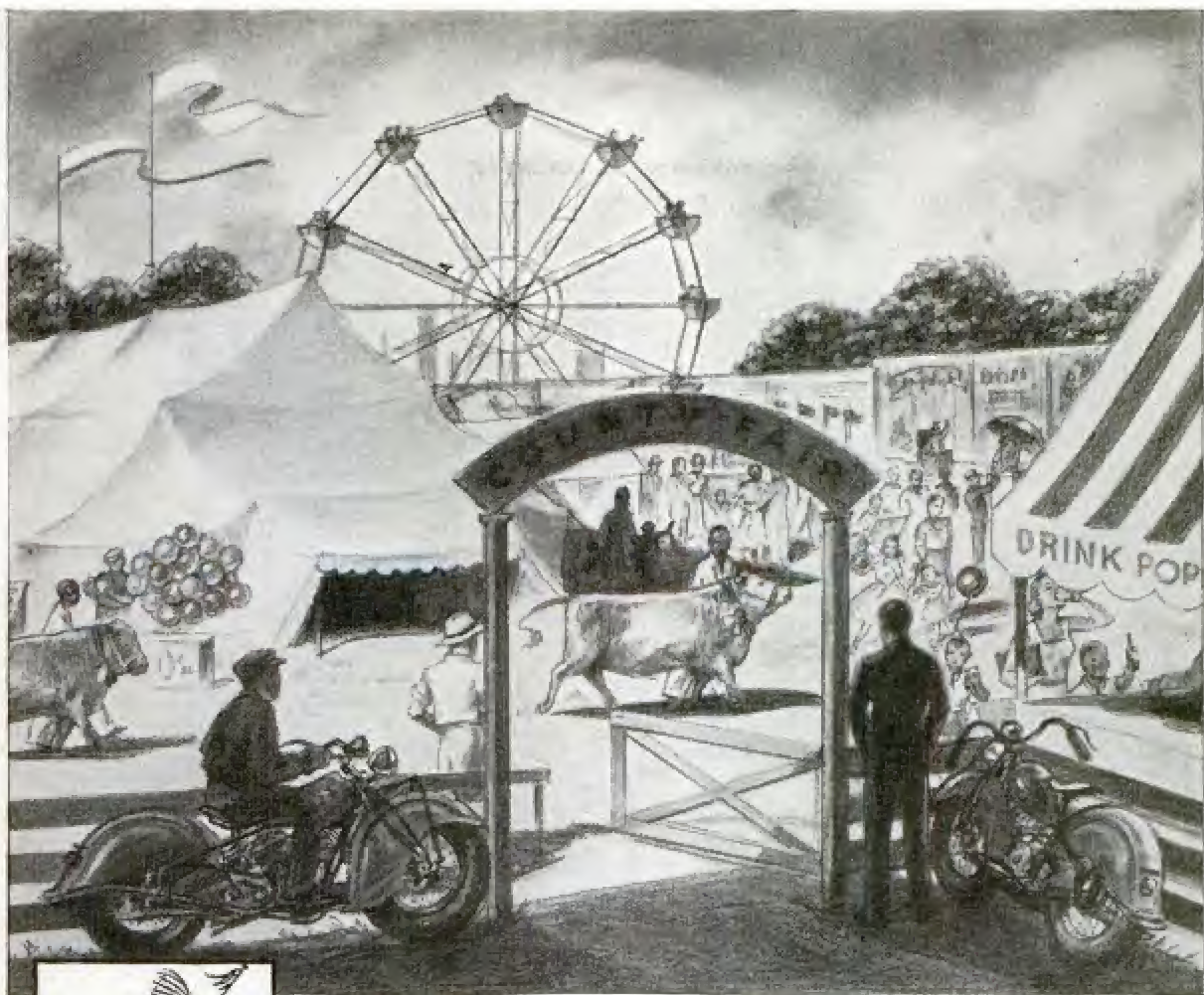
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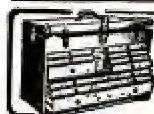


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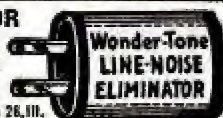
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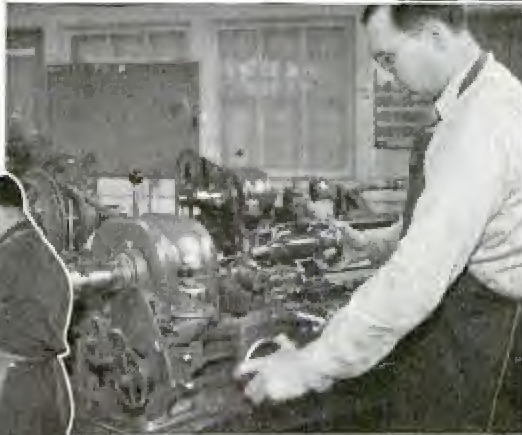
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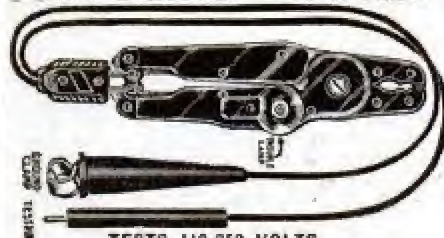
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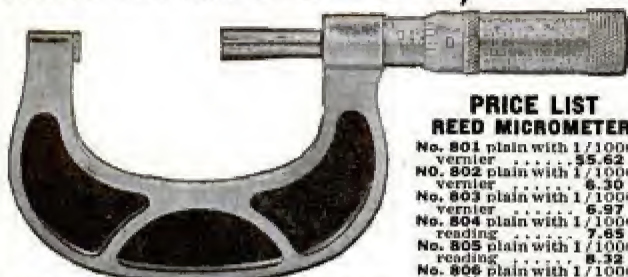
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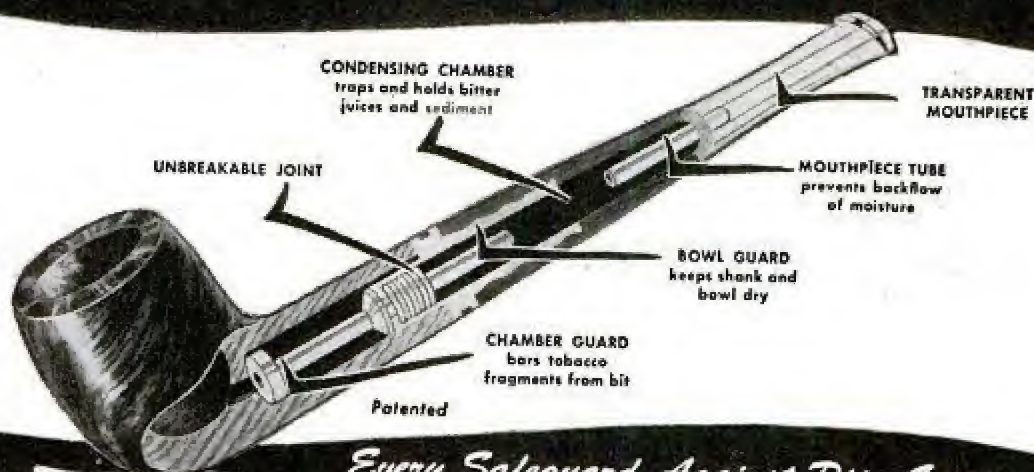
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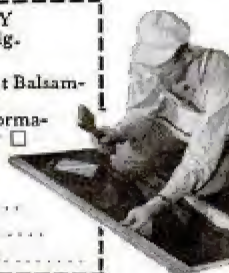
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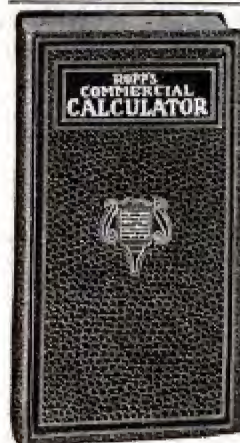
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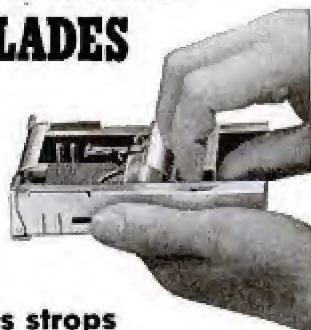
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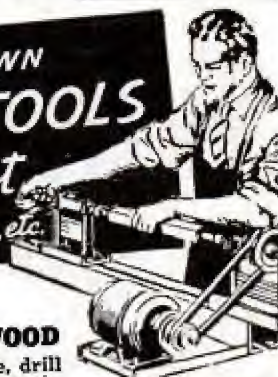
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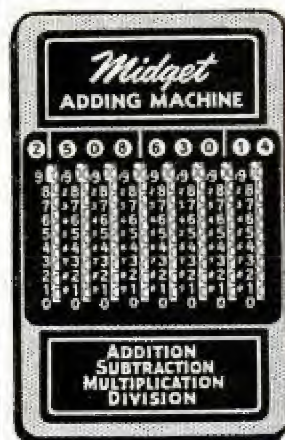
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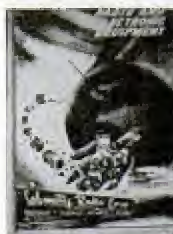
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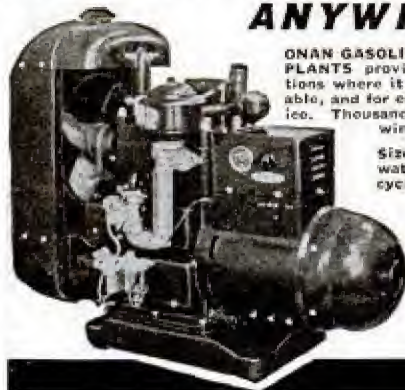
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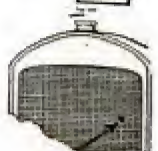
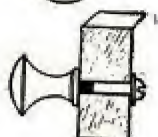
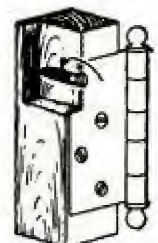
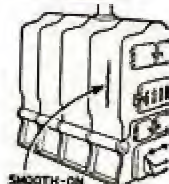
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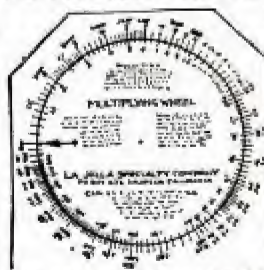
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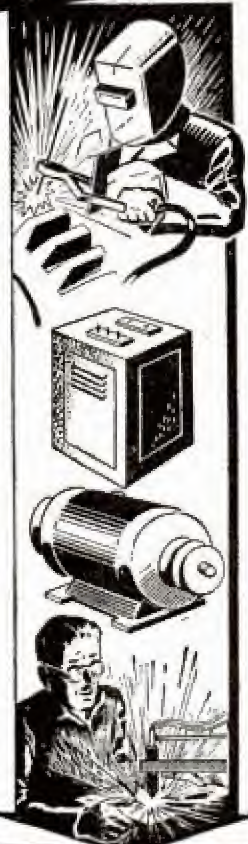
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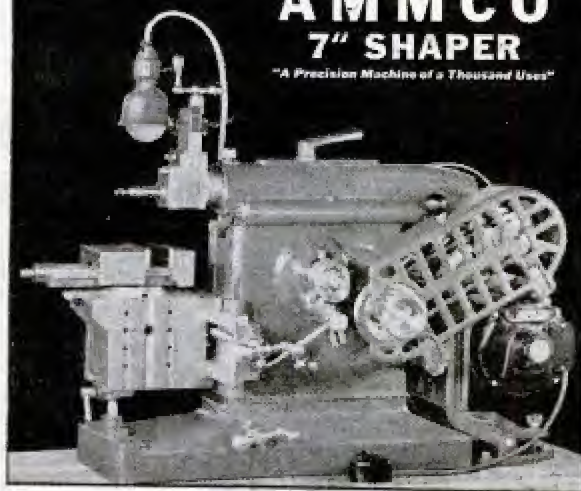
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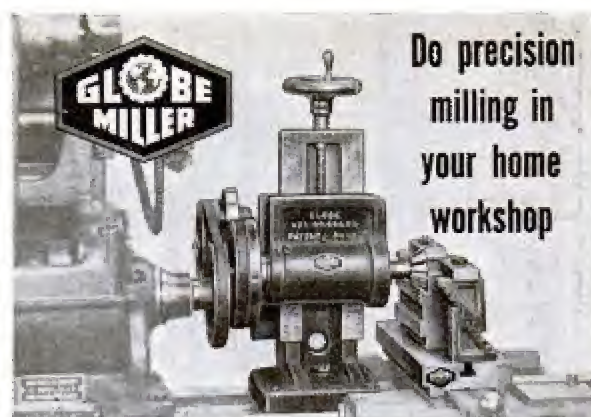
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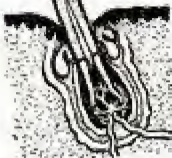
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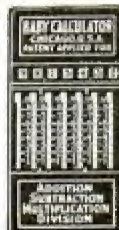
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